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# SPECIFICATIONS

7.1

BATTERY	
Size	12 VDC
Type	Sealed

REGULATOR	
Voltage output @ 75°F	13.8-15 VDC
Amperes @ 3600 RPM	22 Amps

SPARK PLUGS		
Size	12 mm	
Style	6R12	
Gap	0.038-0.043 in.	0.97-1.09 mm
Torque value	11-18 ft-lbs	14.9-24.4 Nm

IGNITION COIL RESISTANCE	
Primary winding	0.5-0.7 ohms
Secondary winding	5500-7500 ohms

ALTERNATOR	
AC voltage output	19-26 VAC per 1000 engine RPM
Stator coil resistance	0.2-0.4 Ohms

ELECTRICAL SYSTEM	AMPERES
Main circuit breaker	30
Ignition fuse	20
Light fuse	15
Accessory fuse	15
Instrument fuse	15
Odometer fuse	15

BULB CHART		BULBS REQUIRED	WATTS	AMPS	PART NUMBER
Headlamp	High/low replaceable bulb	1	60/55	5.0/4.58	67969-96Y
	Position lamp (European models only)	1	4	0.33	67968-96Y
Marker lamps	Tail/stop lamp	1	5/21	0.42/1.75	68075-94Y
	Turn signal lamp, front and rear (1 bulb each)	4	2.0	0.17	68968-99Y
Indicator lamps on instrument support	High beam indicator	1	2.1	0.15	68024-94
	Turn signal indicator	2	2.1	0.15	68024-94
	Oil pressure indicator	1	2.1	0.15	68024-94
	Neutral indicator	1	2.1	0.15	68024-94
Instruments	Speedometer illumination	1	1.7	0.14	67421-99Y
	Tachometer illumination	1	1.7	0.14	68073-99Y
	Low fuel lamp (tachometer)	1	1.7	0.14	68073-99Y
	Check engine lamp (tachometer)	1	1.7	0.14	68073-99Y

## TORQUE VALUES

ITEM	TORQUE		NOTES
Battery cable bolts (1999 Models)	40 in-lbs	4.5 Nm	metric, page 7-26
Battery terminal bolts (2000 Models)	60-96 in-lbs	6.8-10.9 Nm	page 7-32
Dash panel screw	4-5 ft-lbs	5.4-6.8 Nm	page 7-45, page 7-47
Headlamp adjusting screws	6-8 ft-lbs	8.1-10.8 Nm	metric, page 7-35
Neutral indicator switch	3-5 ft-lbs	4.0-6.8 Nm	LOCTITE THREADLOCKER 243 (blue), page 7-56
Rotor mounting bolts	90-110 in-lbs	10.2-10.4 Nm	LOCTITE THREADLOCKER 243 (blue), page 7-22
Spark plugs	11-18 ft-lbs	14.9-24.4 Nm	page 7-1
Stator mounting screws	30-40 in-lbs	3.4-3.5 Nm	T-27 TORX with retaining compound, replace after removal, page 7-22
Switchgear housing screws, left side	25-33 in-lbs	2.8-3.7 Nm	page 7-41
Switchgear housing screws, right side	12-17 in-lbs	1.4-1.9 Nm	page 7-41
Turn signal screws, front	25-28 in-lbs	2.8-3.2 Nm	page 7-37
Turn signal screws, rear	96-120 in-lbs	10.8-13.6 Nm	page 7-38

## GENERAL

The vehicle uses a breakerless inductive-discharge ignition system. The system has both a primary and secondary circuit. The primary circuit consists of the battery, ignition switch, primary coil windings, computerized ignition timer and associated wiring. The secondary circuit consists of the secondary coil, spark plugs and associated wiring. See Figure 7-1.

The scan tool can access the information received by and stored in the electronic control module.

The electronic control module (ECM) attaches to the vehicle frame next to the fuse block. The module has three primary functions. First, it computes the spark advance for proper ignition timing based on sensor input. Second, it controls the independent, primary windings of the spark coil and is thus able to provide sequential and independent firing of the spark plugs (non waste spark). Third, it calculates the correct air/fuel ratio based on input from the sensors.

The electronic control module contains all the solid-state components used in the ignition system. The dwell time for the ignition coil is also calculated by the ECM microprocessor and is dependent upon battery voltage. The programmed dwell is an added feature to keep battery drain to a minimum and to adequately charge the coil at all speeds. The ECM has added protection against transient voltages, continuous reverse voltage protection and damage due to jump starts. The ECM is fully enclosed to protect it from vibration, dust, water and oil. The module is not repairable. Replace the unit if it fails.

The ECM uses six different sensors to monitor rider demands and changing engine conditions. These sensors are:

- Throttle Position (TP) Sensor
- Cam Position (CMP) Sensor
- Intake Air Temperature (IAT) Sensor
- Engine Temperature (ET) Sensor
- Oxygen (O2) Sensor
- Bank Angle Sensor (BAS)

The ECM uses the information provided by the TP and CMP sensors to calculate how much air is entering the engine. The TP Sensor monitors the amount of air entering the engine by how far the throttle is open, whether it is opening or closing and how fast it is opening or closing. The IAT sensor measures the temperature of the air entering the engine, providing the rest of the information necessary to determine the density of the air entering the engine. The ECM also monitors the CMP sensor to determine the exact position of both cylinders in the combustion cycle and the engine speed.

The ET sensor provides the ECM the current engine temperature. Proper fuel and spark delivery are dependent on the temperature of the engine. The ECM will provide a richer fuel mixture on start up and a higher degree of spark advance. As the vehicle warms up to operating temperature the fuel mixture will lean and the spark advance will decrease.

The information provided by the O2 sensor allows the ECM to ensure a proper air/fuel mixture by monitoring the final combustion efficiency in the exhaust system. This ensures optimum engine performance at any altitude or barometric pressure. The O2 sensor input to the ECM is required to ensure a stoichiometric (14.6:1) air/fuel ratio during closed loop operation.

The Bank Angle Sensor (BAS) provides input to the ECM on whether the vehicle lean is greater than 55 degrees. As long as lean angle does not exceed 55 degrees fuel supply and ignition operation are unaffected. If the vehicle exceeds a 55 degree lean angle, the BAS will interrupt the operation of the ignition system and fuel supply.

The ECM-controlled ignition coil fires each spark plug independently on the compression stroke of each cylinder (no waste spark). The spark plug in the front cylinder fires at the end of that cylinder's compression stroke, thereby igniting the air/fuel mixture. The same sequence occurs at the end of the rear cylinder's compression stroke (thereby igniting the air/fuel mixture in the rear cylinder).

The rotor and cam position sensor are located in the gear-case cover on the right side of the motorcycle. The Cam position sensor consists of a Hall-effect device, magnet and plate. The plate is mounted over a rotating cup ("rotor cup"). The rotor cup is mounted on the camshaft and operates at one-half crankshaft speed. As the rotor cup turns inside the gear-case, six asymmetrical teeth on the rotor cup sequentially break the magnetic field between the magnet and the Hall-effect device. The edges of these teeth are cut to correspond to specific positions of the camshaft during the engine cycle such as TDC for the front cylinder. The output of the CMP sensor is used by the ECM to not only determine engine position, but also to calculate engine speed. This method of measuring camshaft position provides accurate information on engine position down to zero engine speed.

For more information on the sensors used in conjunction with the ECM see Section 4 Fuel System.

See the wiring diagrams at the end of this section for additional information on ignition system circuits.

## TROUBLESHOOTING

See Section 4 Fuel System for troubleshooting information.



1. Pop rivet (2)
2. Timer cover
3. Screw (2)
4. Inner cover
5. Timer plate stud (2)
6. Bolt
7. Cam position sensor (CMP)
8. Trigger rotor
9. Seal
10. Gearcase cover
11. Spark plug (2)
12. Ignition coil
13. Front spark plug cable
14. Rear spark plug cable
15. Cable strap- 16. Terminal pin
- 17. CMP connector [14]
- 18. Secondary lock
- 19. Ignition module
- 20. Washer (2)
- 21. Screw (2)

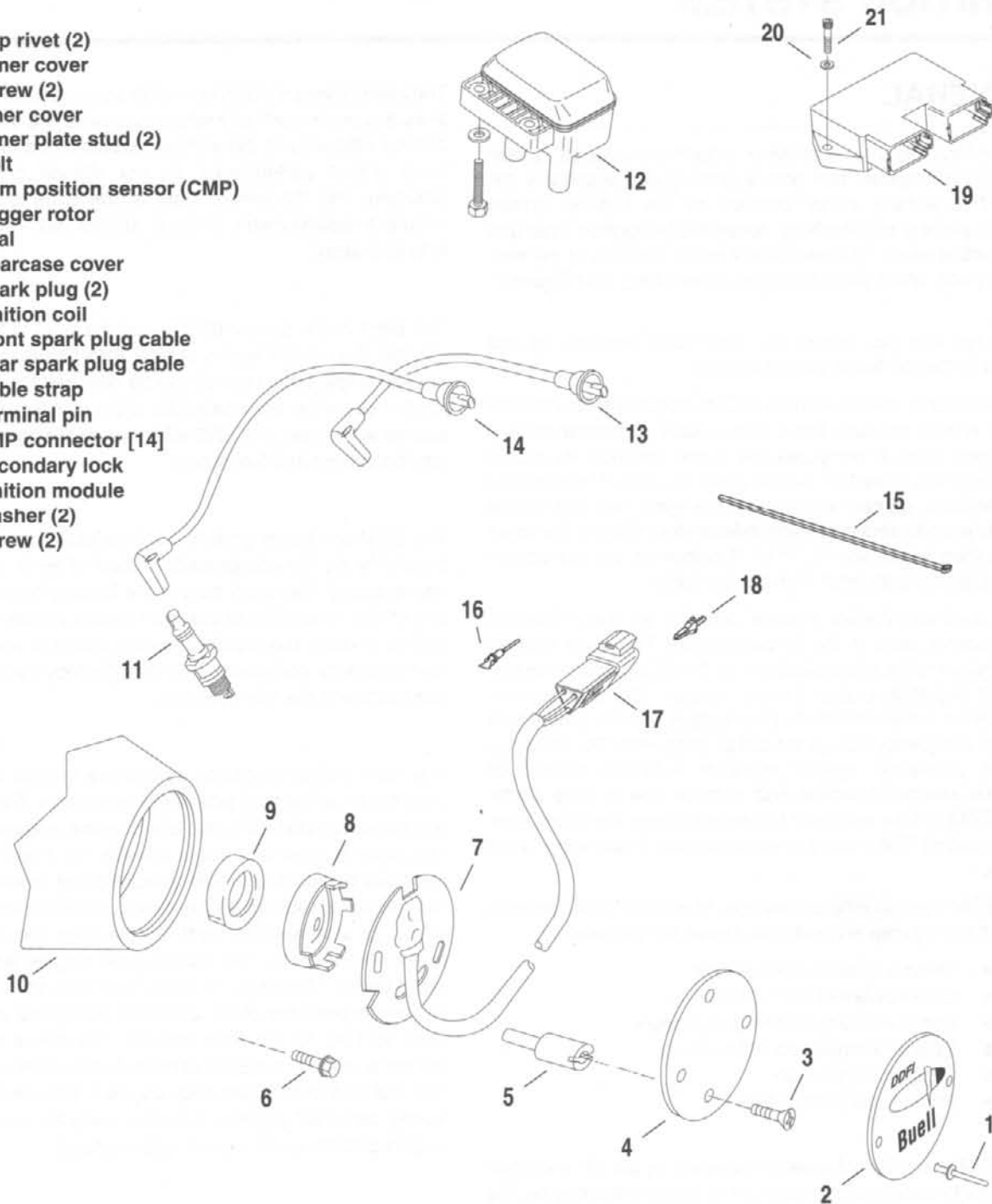


Figure 7-1. Ignition System Components

## GENERAL

### ⚠ WARNING

DO NOT modify the ignition/headlamp switch wiring to circumvent the automatic-on headlamp feature. Visibility is a major concern for motorcyclists. Failure to have proper headlamp operation could result in death or serious injury.

See Figure 7-2. The three-position combination ignition/headlamp key switch is not repairable. Replace the unit if it fails.

Switch positions are explained in Table 7-1.

### CAUTION

When turning off the ignition, verify that the key is removed in the OFF position and that the lights are not left on. If the rider stops the engine and inadvertently removes the key in the P position, the battery will be drained of its charge if the vehicle is left standing too long.

### NOTE

The key locks the ignition system and is removable in both the LOCK and P positions. The P position is located between the OFF and IGNITION positions and allows the rider to remove the key while leaving the lights on. When the key is placed in the P position, several indicator markers are or can be activated. See Table 7-2.

## REMOVAL

### ⚠ WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury

1. Disconnect battery cables, negative cable first.
2. Remove four screws and washers to detach windscreen from mounting brackets.
3. Disconnect ignition key switch connector [33] from main wiring harness.
4. See Figure 7-2. Remove ignition switch face nut (2). Remove ignition switch (1) from behind dash panel.

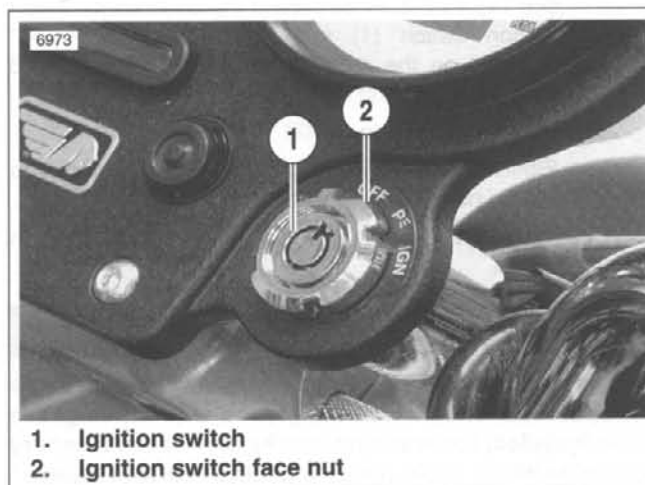


Figure 7-2. Ignition/Headlamp Key Switch

Table 7-1. Ignition Key Switch Positions

LABEL	NAME	IGN.	LAMPS	REMOVE KEY
OFF	locked	off	off	yes
P	markers	off	See note & Table 7-2.	yes
IGN	ignition	on		no

Table 7-2. Indicator Markers

ITEM	P	IGN
Headlamp position marker (European models only)	on	on
Headlamp high/low beam	off	on
Speedometer illumination lamp	on	on
Stop lamp	can be activated	
Front and rear turn signals	can be activated	
Horn	can be activated	

## INSTALLATION

1. Install ignition key switch.
  - a. See Figure 7-2. From behind the dash panel, insert ignition switch (1) into hole. The word "TOP" stamped on the switch body should face upward toward the lettering on the switch position decal.
  - b. Loosely install face nut (2).
2. See Figure 7-3. Attach ignition key switch connector to main wiring harness.
3. See Figure 7-2. Tighten face nut to secure switch within dash panel.

### WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

4. Install battery cables, positive cable first.

### WARNING

Check for proper headlamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper headlamp operation could result in death or serious injury.

5. Check ignition key switch for proper operation. If operation fails, reread procedure and verify that all steps were performed.
6. Install four screws and washers to attach windscreen to mounting brackets.

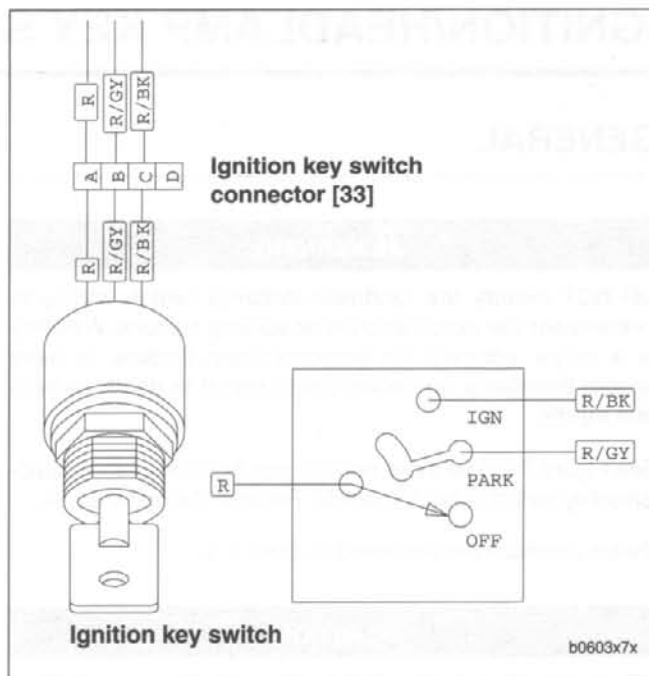


Figure 7-3. Ignition Key Switch Wiring

## SPARK PLUG CABLES

7.4

### GENERAL

Resistor-type high-tension spark plug cables have a carbon-impregnated fabric core, instead of solid wire, for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

### REMOVAL

#### ⚠ WARNING

Never disconnect a spark plug cable with the engine running. If you disconnect a spark plug cable with the engine running, you may receive a potentially fatal electric shock from the ignition system which could result in death or serious injury.

#### CAUTION

When disconnecting each spark plug cable from its spark plug terminal, always grasp and pull on the rubber boot at the end of the cable assembly (as close as possible to the spark plug terminal). Do not pull on the cable portion itself. Pulling on the cable will damage the cable's carbon core.

Disconnect spark plug cables from ignition coil and spark plug terminals. Inspect all removed cables for damage.

### INSPECTION

1. Inspect spark plug cables. Replace cables that are worn or damaged.
  - a. Check for cracks or loose terminals.
  - b. Check for loose fit on ignition coil and spark plugs.
2. Check cable boots/caps for cracks or tears. Replace boots/caps that are worn or damaged.
3. See Figure 7-4. Check spark plug cable resistance with an ohmmeter. Replace cables not meeting resistance specifications.
  - a. 4750-11,230 ohms for 19.0 in. (483 mm) cable.
  - b. 1812-4375 ohms for 7.25 in. (184 mm) cable.

### INSTALLATION

Connect spark plug cables to ignition coil and spark plugs. Fasten boots/caps securely. Tight connections provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.

#### NOTE

See 1.20 SPARK PLUGS for spark plug information.

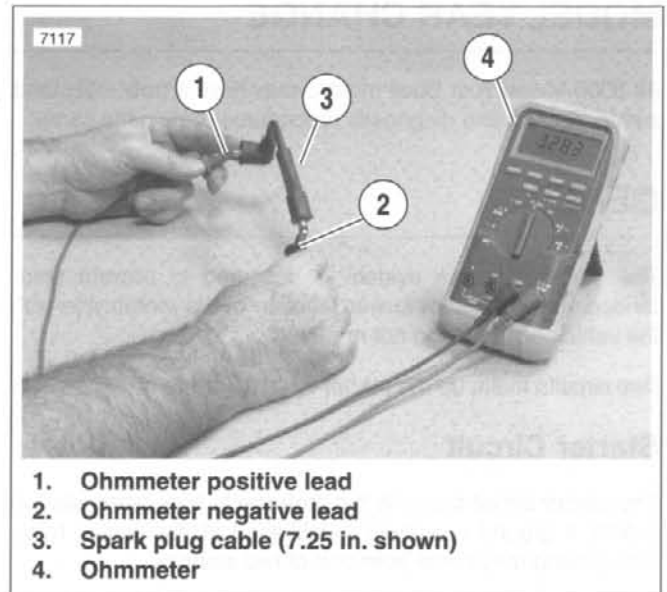


Figure 7-4. Testing Resistance

## MODEL YEAR CHANGE

All 2000 Model Year Buell motorcycles have a **new** sidestand switch. Testing and diagnostic procedures remain the same.

## GENERAL

The starter interlock system is designed to prevent unintended start-up and/or forward motion of the motorcycle with the vehicle's side stand not retracted.

Two circuits make up the starter interlock system.

### Starter Circuit

The starter circuit prevents the motorcycle from being started unless a ground has been established at the starter relay. This ground may come from one of two sources.

- By placing the motorcycle in neutral and grounding through the neutral switch.
- By disengaging the clutch and grounding through the clutch lever switch.

Once the starter circuit is grounded and the starter button pushed, the starter relay can be energized. The energized relay then permits the starter motor to crank the engine.

### Ignition Circuit

The ignition circuit prevents the motorcycle from operating unless a ground is established at the ignition relay. If this ground is not established, the ignition system will be not turned on and the motorcycle will not run. Grounds may be established three ways.

- By retracting the side stand and grounding through the side stand switch.
- By placing the motorcycle in neutral and grounding through the neutral switch.
- By disengaging the clutch and grounding through the clutch lever switch.

Note that the ignition circuit allows operation in gear with the side stand extended if the clutch is disengaged. However, if the motorcycle is in gear with the side stand extended, and the clutch is released, the ignition ground is lost and the ignition system is turned off. This system will prevent vehicle operation if forward motion is attempted with the side stand down.

See Figure 7-8.

**Table 7-3. Starter Interlock Troubleshooting**

PROBLEM	CHECK FOR	CORRECTION
Electric starter will not crank.	Battery problems.	See 7.9 BATTERY (1999 MODELS).
	Inappropriate gear selected.	Place vehicle in neutral.
	Clutch lever not disengaged.	Pull in clutch lever.
	Starter relay problems.	Listen for starter relay "click". If click is not heard, perform starter relay tests.
		Follow starter troubleshooting in Section 5.
Electric starter cranks, but vehicle will not start.	Side stand not retracted.	Retract side stand.
Motorcycle will not start with side stand retracted.	Clutch lever not disengaged.	Pull in clutch lever.
Motorcycle will not start with side stand retracted or clutch disengaged.	Ignition relay problems.	Listen for relay "click". If click is not heard, perform ignition system tests.
Motorcycle will not start after starter relay tests.	No spark at spark plug.	Check for 12 VDC at coil W/BK wire.
		Follow ignition system troubleshooting.

## DIAGNOSTICS

The reference numbers below correlate with the circled numbers in the 7.5 STARTER INTERLOCK flow charts.

1. Check diode with an ohmmeter as shown in Figure 7-5.
2. Check diode polarity as shown in Figure 7-6.

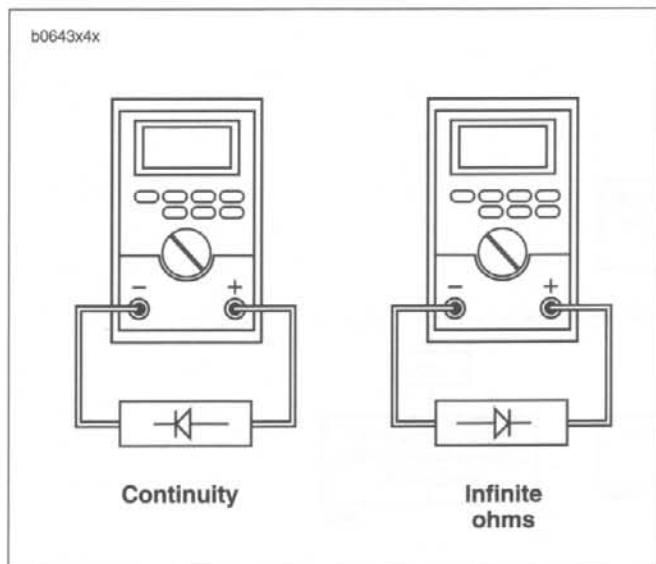


Figure 7-5. Ohmmeter Diode Test

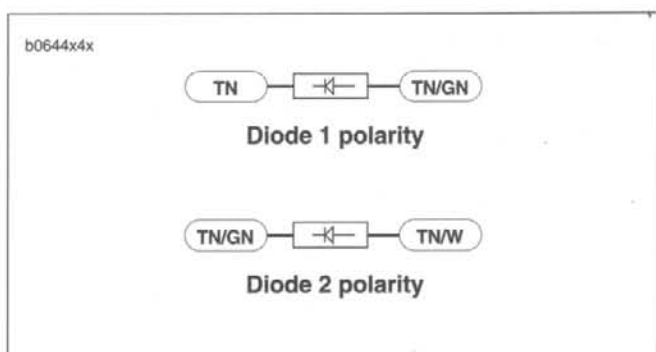


Figure 7-6. Diode Polarity

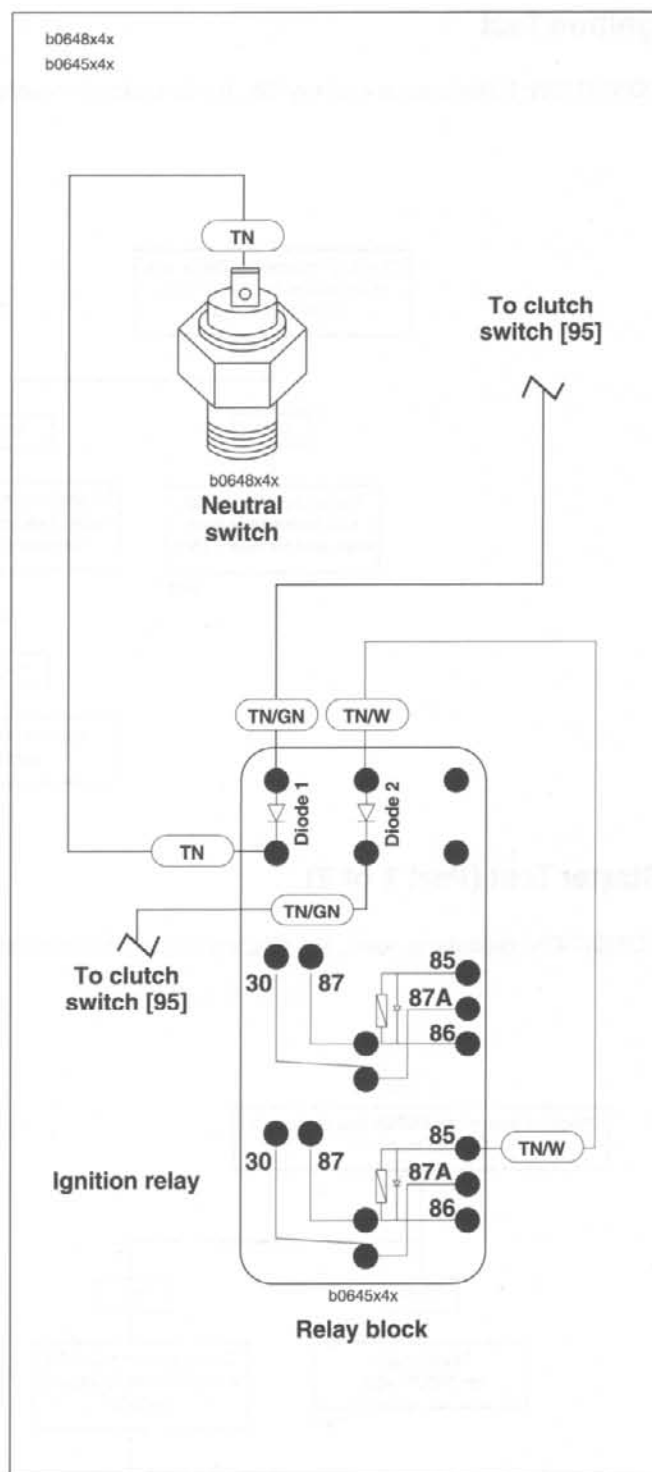
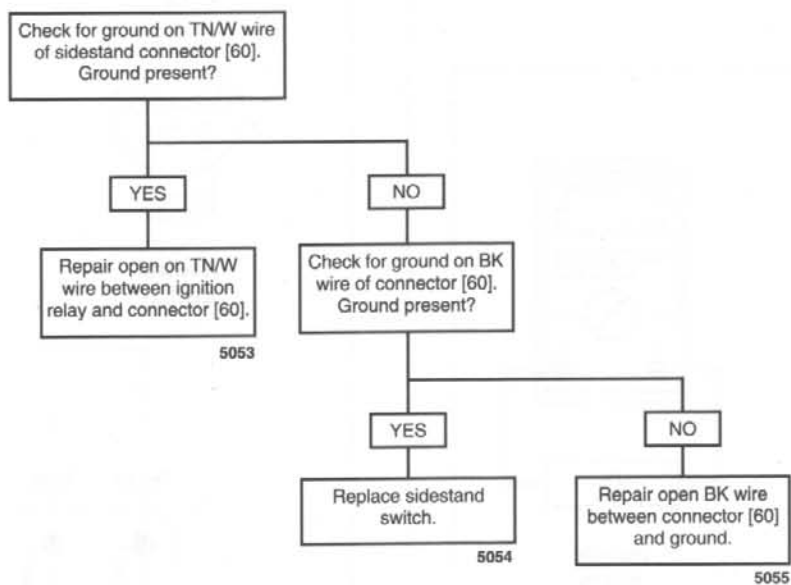


Figure 7-7. Diode Wiring



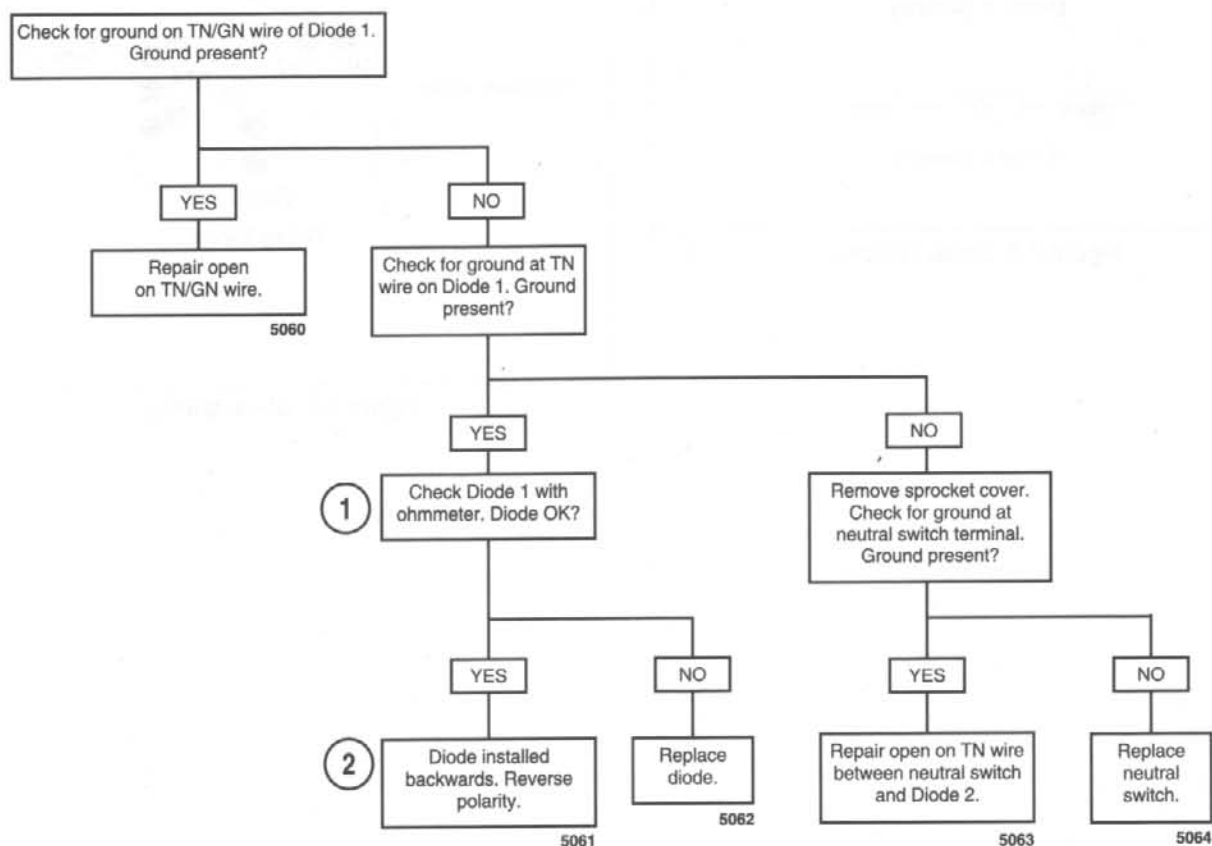
## Ignition Test

CONDITION: Sidestand up and key ON, transmission in neutral and clutch engaged



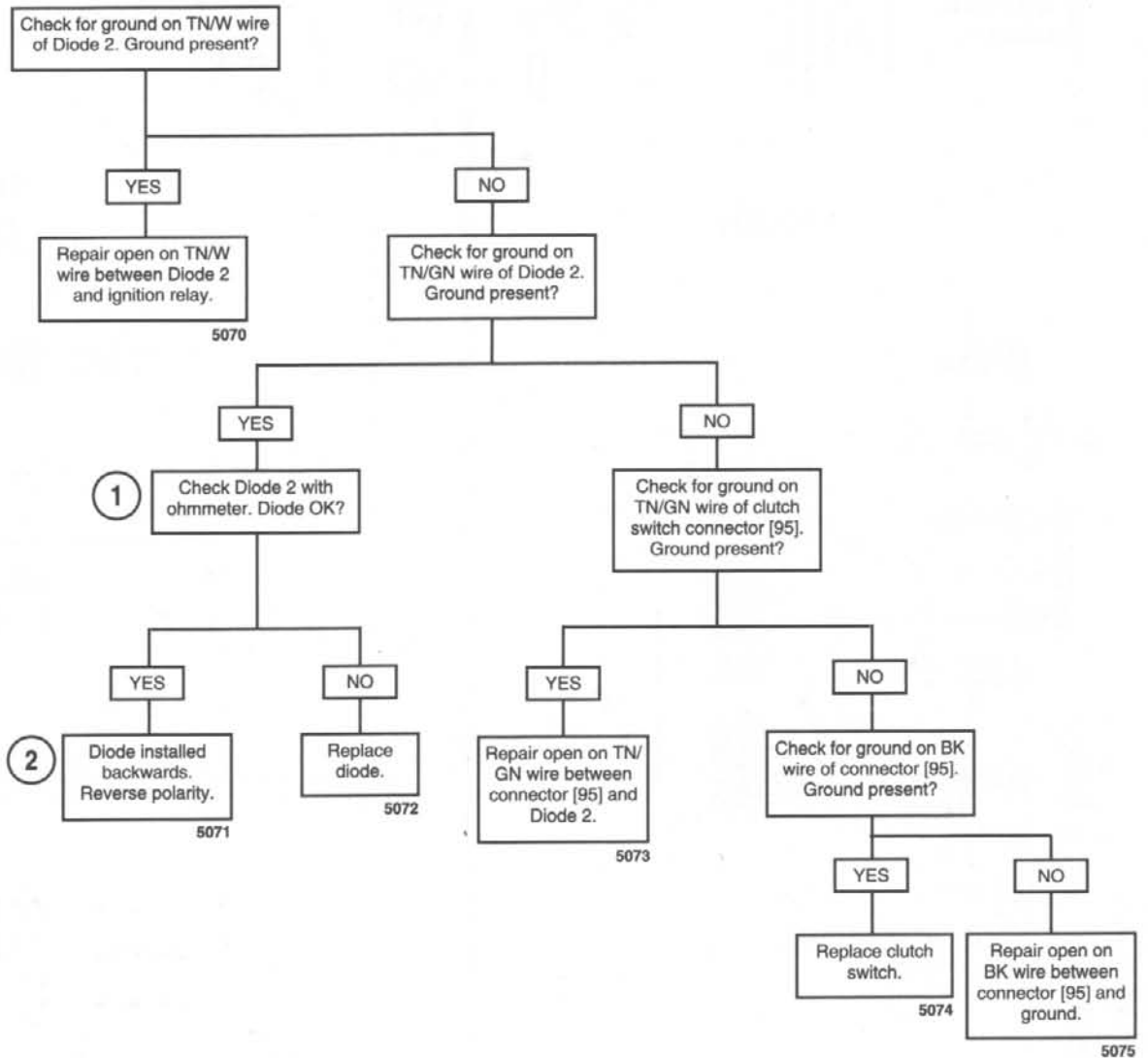
## Starter Test (Part 1 of 2)

CONDITION: Sidestand down, key ON, transmission in neutral and clutch engaged



## Starter Test (Part 2 of 2)

CONDITION: Sidestand down, key ON, transmission in gear and clutch disengaged



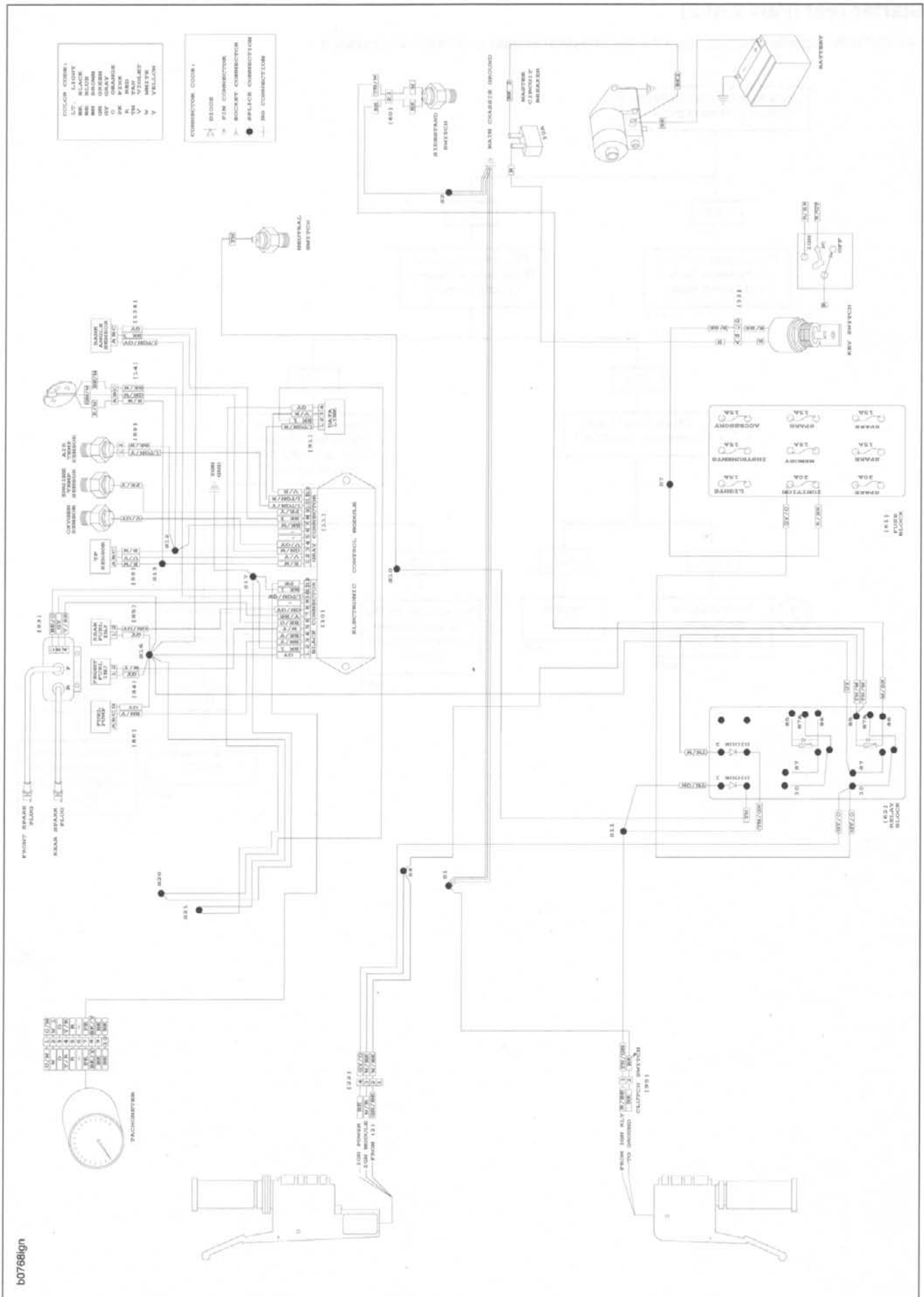


Figure 7-8. Starter/Ignition Interlock System

## TESTING/REPLACEMENT

### Side Stand Switch

See Figure 7-9. The side stand switch is a simple spring loaded plunger. The switch completes a path to ground for the ignition relay when the side stand is in the retracted position. Test the switch as follows:

1. Unplug the 2-place side stand switch connector [60].
2. Test the switch using an ohmmeter.
  - a. With side stand down (1) (switch open), the switch should show  $\infty$  ohms (infinite ohms).
  - b. With side stand up (2) (switch closed), the switch should show 0 ohms or little resistance.
3. Replace the assembly with a **new** switch if necessary.  
**1999 Models:** Remove side stand switch from frame by turning counterclockwise.  
**2000 Models:** Remove side stand switch from frame by removing two nuts.

### Clutch Switch

See Figure 7-10. The clutch switch attaches to the clutch control lever bracket. The switch completes a path to ground for the ignition relay and the starter relay when the clutch is disengaged. Test the switch as follows:

1. Unplug the 2-place clutch switch connector [95].
2. Test the switch using an ohmmeter.
  - a. With clutch engaged (1) (switch open), the switch should show  $\infty$  ohms (infinite ohms).
  - b. With clutch disengaged (2) (switch closed), the switch should show 0 ohms or little resistance.
3. Replace the assembly with a **new** switch if necessary.
  - a. Remove small Phillips screw.
  - b. Depress clutch lever and hold.
  - c. Detach switch by depressing switch trigger button and pulling switch towards the end of the handlebar.
  - d. Install **new** switch.

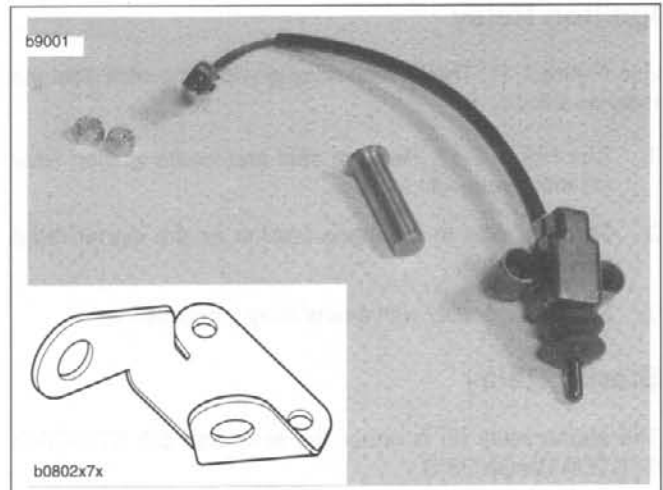
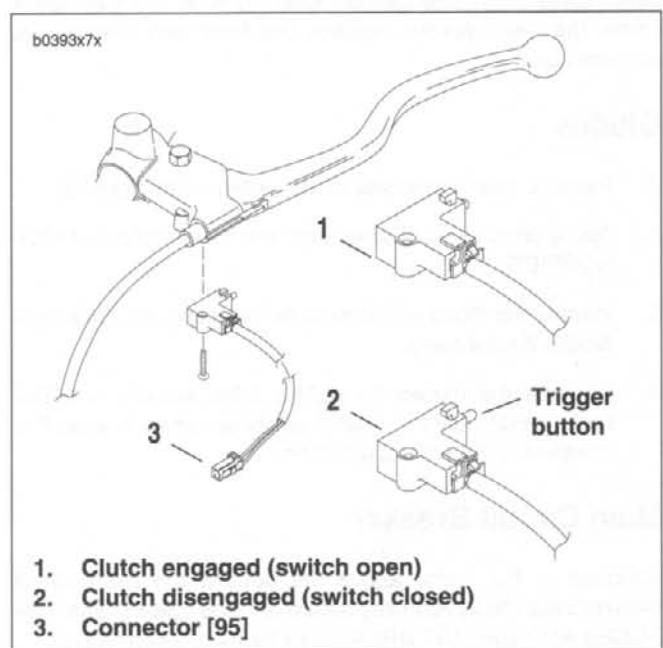


Figure 7-9. Side Stand Switch and Bracket (2000 Models)



1. Clutch engaged (switch open)
2. Clutch disengaged (switch closed)
3. Connector [95]

Figure 7-10. Clutch Switch

## Ignition Relay

See Figure 7-11. The ignition relay is under the seat. Test the relay as follows:

1. See Figure 7-12. Remove seat and locate ignition relay (1) within relay/diode block.
2. Test the relay in the same fashion as the starter relay. See Section 5.
3. Replace the relay with a **new** relay if necessary.

## Starter Relay

The starter relay (2) is under the seat. See 5.3 STARTING SYSTEM DIAGNOSIS.

## Ignition Fuse

See Figure 7-11. The ignition fuse (3) is in the fuse block under the seat. Always replace the fuse with another 20 ampere fuse.

## Diodes

1. Remove seat and locate diodes within relay block (2).
2. Test diodes using Starter Test flow charts under DIAGNOSTICS.
3. Identify the diode which must be replaced. Replace both diodes if necessary.
4. Replace the diodes by pulling them straight out. The spare diode may be used in either circuit as long as it is installed in the correct direction.

## Main Circuit Breaker

Attached to the frame above the battery, the main circuit breaker links the ignition key switch and the battery. See 7.24 FUSES AND CIRCUIT BREAKERS for more information.

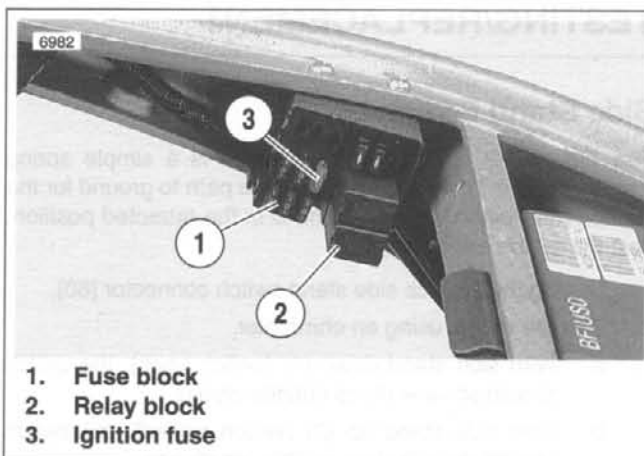


Figure 7-11. Fuse and Relay Blocks

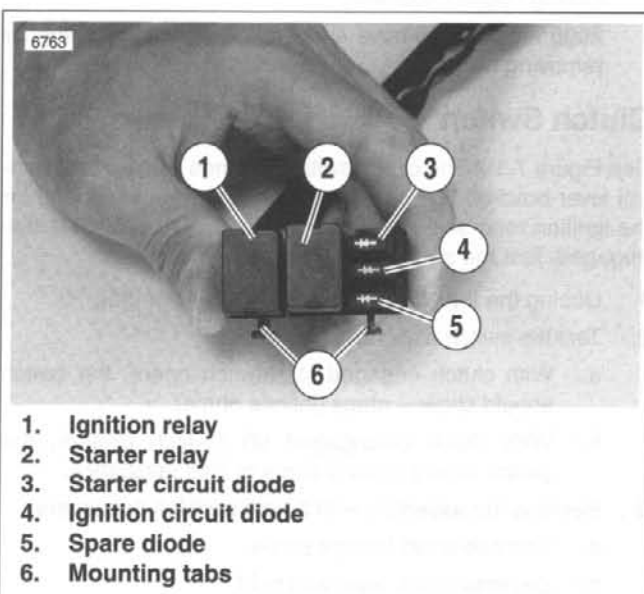


Figure 7-12. Ignition Relay and Diodes

## GENERAL

The charging system consists of the alternator and regulator. Charging system circuits are shown in Figure 7-16.

### Alternator

The alternator consists of two main components:

- The rotor which mounts to the engine sprocket shaft.
- The stator which bolts to the engine crankcase.

### Voltage Regulator

See Figure 7-13. The voltage regulator is a series regulator with shunt control. The circuit combines the functions of rectifying and regulating.

## TROUBLESHOOTING

When the charging system fails to charge or does not charge at a satisfactory rate, make the following recommended checks.

### Battery

Check for a weak or dead battery. See 7.9 BATTERY (1999 MODELS) or 7.11 BATTERY (2000 MODELS). Battery must be fully charged in order to perform any electrical tests.

### Wiring

Check for corroded or loose connections in the charging circuit. See Figure 7-16.

### Voltage Regulator Inspection

See Figure 7-13. The voltage regulator base must have a clean, tight connection for proper grounding. Check by using an ohmmeter with one lead on a known good ground, such as battery ground cable, and the other on the regulator base.

See Figure 7-14. Connector plug to stator must be clean and tight.

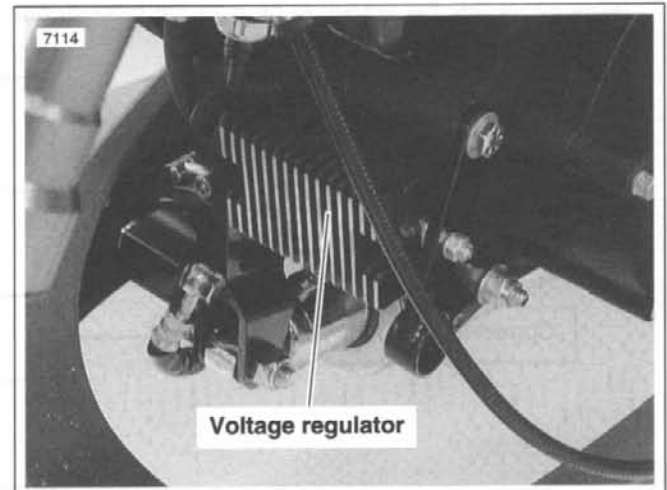


Figure 7-13. Voltage Regulator

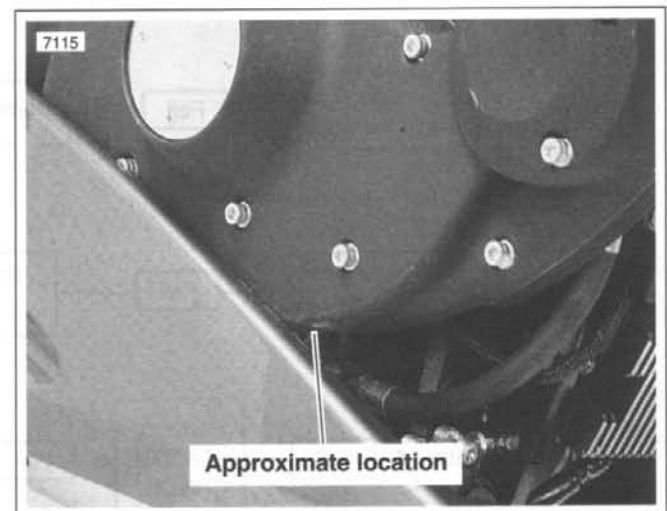


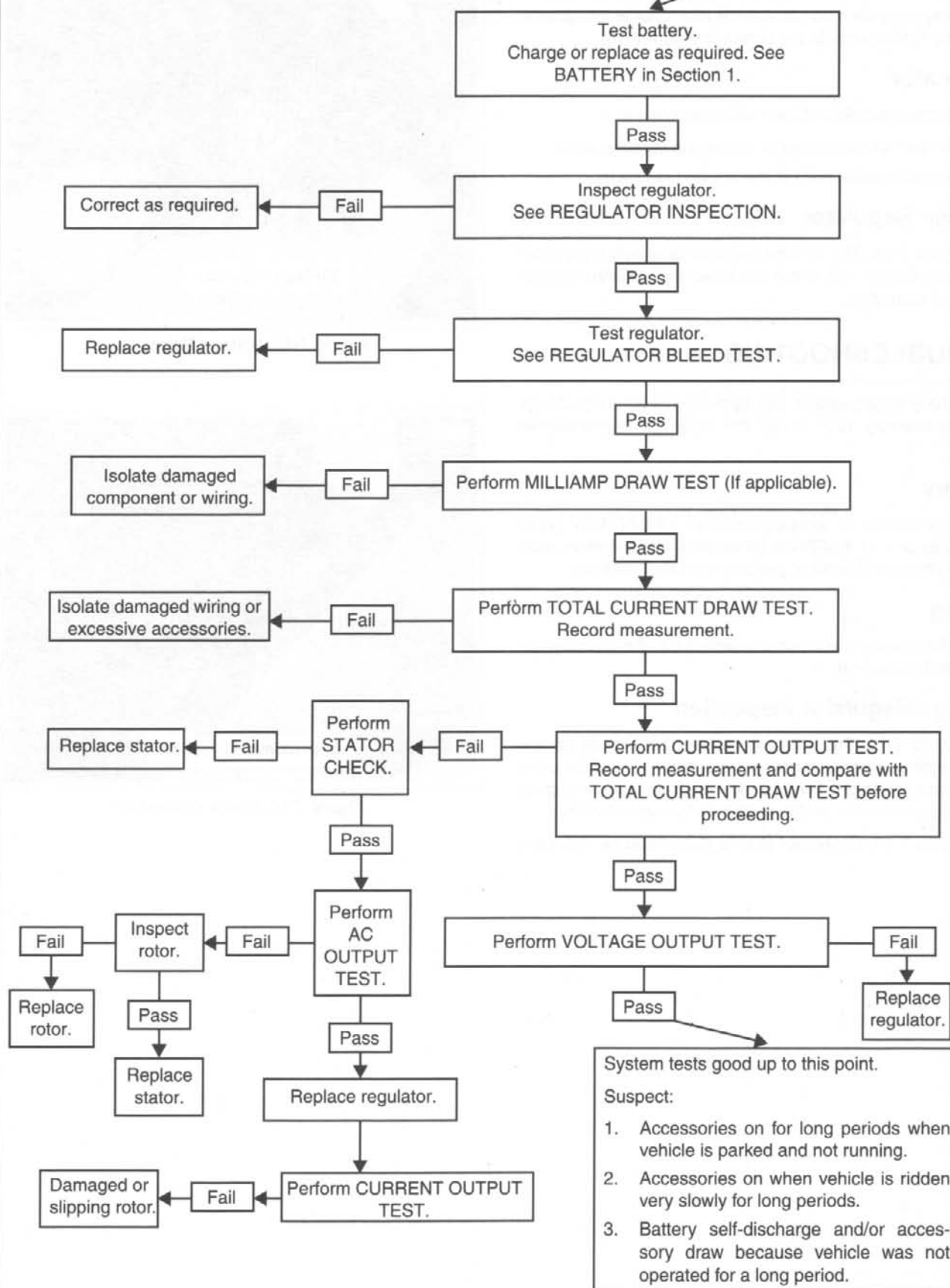
Figure 7-14. Stator Connector



**NOTE**

Whenever a charging system component fails a test and is replaced, re-test the system to be sure the problem has been corrected.

**SYMPTOM:  
BATTERY BECOMES DISCHARGED**



**Figure 7-15. Charging System Troubleshooting**

b0749chr

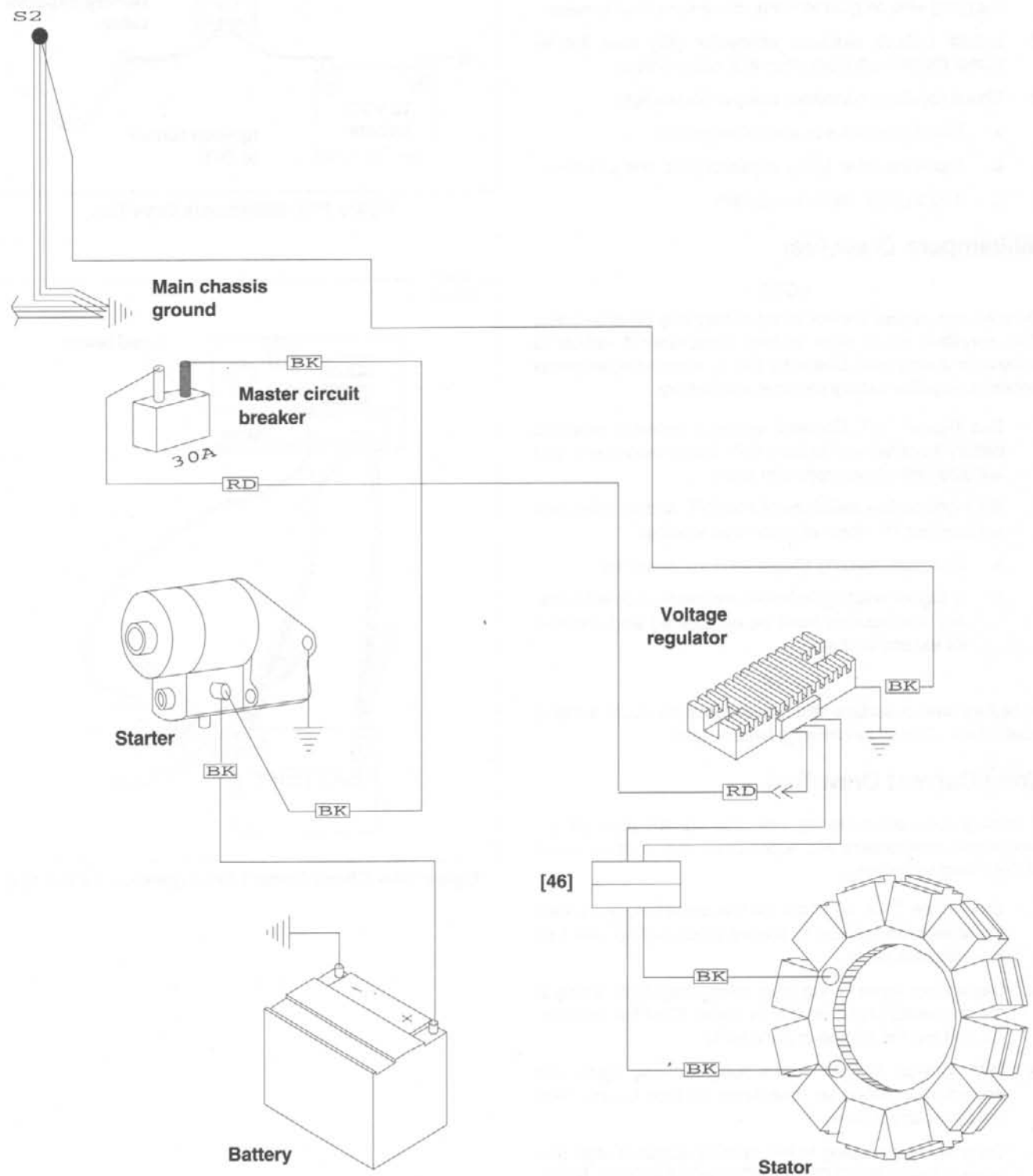


Figure 7-16. Charging System Circuit

## TESTING

### Voltage Regulator Bleed Test

1. Be sure regulator is connected to battery. Check BK charging wire on gold terminal of master circuit breaker.
2. Locate voltage regulator connector [46] near the oil pump. Disconnect from alternator stator wiring.
3. Check regulator connector using a trouble light.
  - a. Touch one probe to a suitable ground.
  - b. Touch the other to the regulator pins, one at a time.
  - c. If light glows, replace regulator.

### Milliampere Draw Test

#### NOTE

Be sure accessories are not wired so they stay on at all times. This condition could drain battery completely if vehicle is parked for a long time. Check for this by connecting ammeter between negative battery terminal and battery.

1. See Figure 7-17. Connect ammeter between negative battery terminal and battery. With this arrangement, you will also pick up any regulator drain.
2. With ignition key switch turned to OFF and all lights and accessories off, observe amperage reading.
  - a. Maximum reading should be 3 milliamperes.
  - b. A higher reading indicates excessive current draw. Any accessories must be considered and checked for excessive drain.

#### NOTE

A battery with a surface discharge condition could suffer a static drain. Correct by cleaning battery case.

### Total Current Draw Test

If battery runs down during use, the current draw of the motorcycle components and accessories may exceed output of the charging system.

1. See Figure 7-18. To check for this condition, place load tester induction pickup or current probe pickup over battery negative cable.
2. Disconnect stator wiring from voltage regulator wiring at the connector [46] near the oil pump. Start the motorcycle and run the engine at 2000 RPM.
3. With ignition and all continuously running lights and accessories turned on (headlamp on high beam), read the total current draw.
4. Compare this reading to the reading obtained after performing the CURRENT AND VOLTAGE OUTPUT TEST.
  - a. The current output should exceed current draw by 3.5 amps minimum.
  - b. If output does not meet specifications, there may be too many accessories for the charging system to handle.
5. Reconnect regulator after testing.

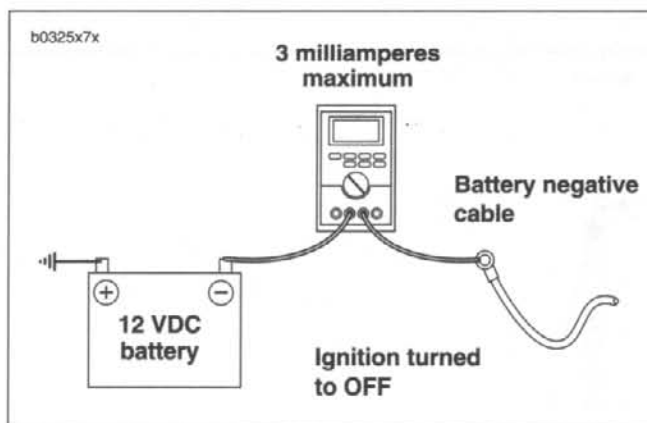


Figure 7-17. Milliampere Draw Test

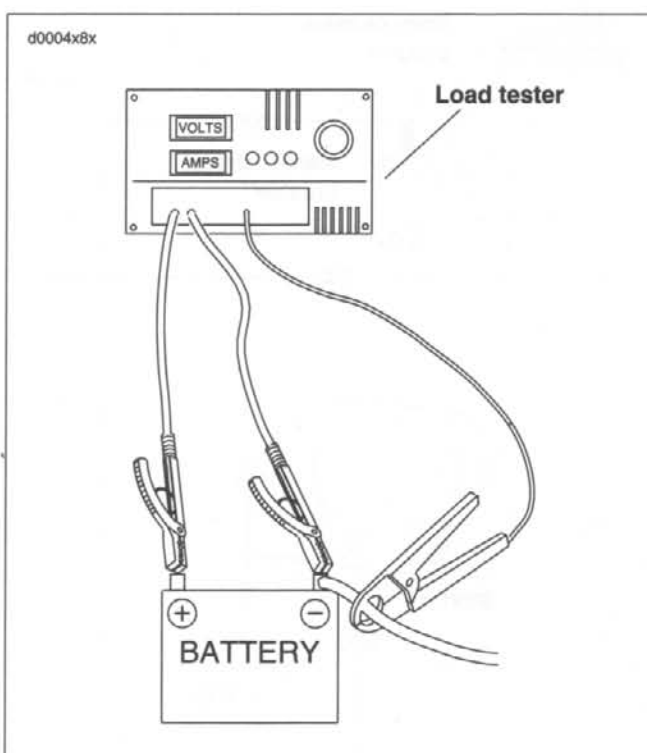


Figure 7-18. Check Current Draw (Ignition Switch On)

## Current and Voltage Output Test

1. See Figure 7-19. Connect load tester.
  - a. Connect negative and positive leads to battery terminals.
  - b. Place load tester induction pickup over positive regulator cable.

### CAUTION

**Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.**

2. Run the engine at 2000 RPM. Increase the load as required to obtain a constant 13.0 VDC.
3. The current output should be 19-23 amps. Make note of measurement for use in TOTAL CURRENT DRAW TEST.

### NOTE

*Rider's habits may require output test at lower RPM.*

## Voltage Output Test

1. See Figure 7-19. After removing the load, read the load tester voltage meter.
  - a. If voltage to the battery is not more than 15 VDC, voltage output is within specifications. Investigate other possible problems. See Figure 7-15.
  - b. If voltage is higher, regulator is not functioning properly or connections are loose or dirty.

## Stator Check

1. Turn ignition key switch to OFF.
2. See Figure 7-20. Connect an ohmmeter.
  - a. Locate voltage regulator connector [46] near the oil pump. Disconnect from alternator stator wiring.
  - b. Insert one ohmmeter lead into either stator socket.
  - c. Attach the other lead to a suitable ground.
3. Test for continuity with ohmmeter set on the RX1 scale.
  - a. A good stator will show no continuity ( $\infty$  ohms) across either stator socket.
  - b. Any other reading indicates a grounded stator which must be replaced.
4. See Figure 7-21. Remove ground lead. Insert lead into the remaining stator socket.
5. Test for resistance with ohmmeter set on the RX1 scale.
  - a. Resistance across the stator sockets should be 0.2-0.4 ohms.
  - b. If the resistance is lower, the stator is damaged and must be replaced.

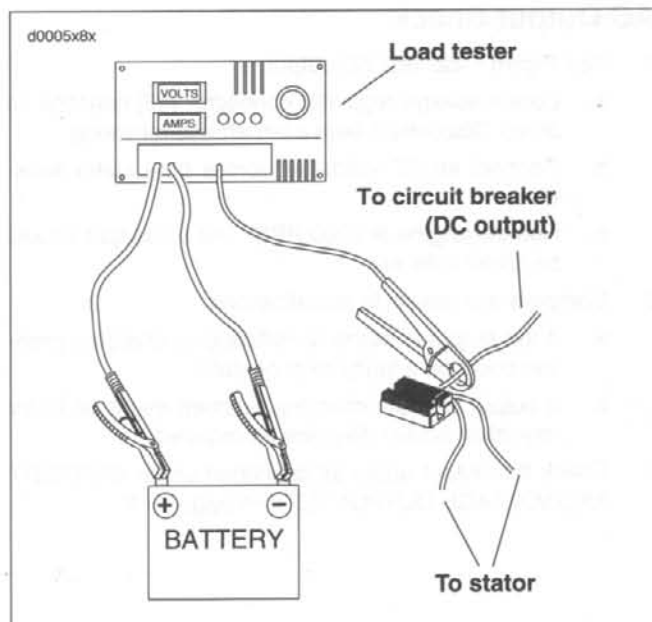


Figure 7-19. Current and Voltage Output Test

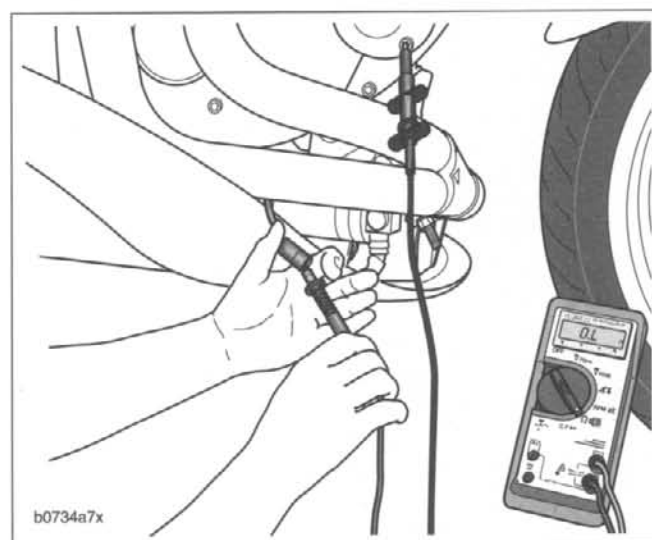


Figure 7-20. Test for Grounded Stator

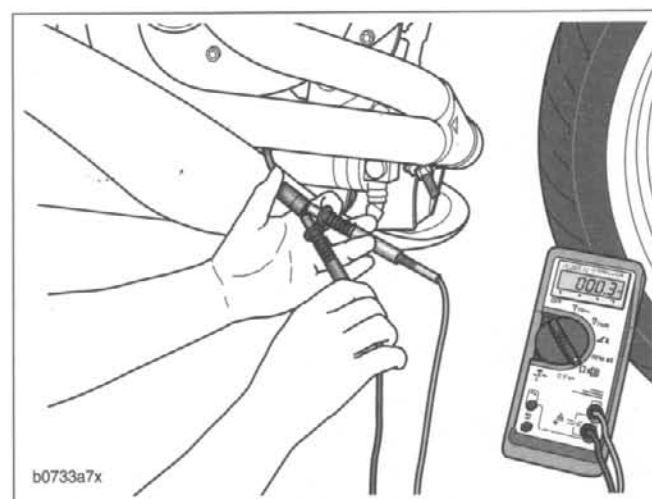


Figure 7-21. Check for Stator Resistance

## AC Output Check

1. See Figure 7-22. Test AC output.
  - a. Locate voltage regulator connector [46] near the oil pump. Disconnect from alternator stator wiring.
  - b. Connect an AC voltmeter across both stator sockets.
  - c. Run the engine at 2000 RPM. The AC output should be 38-52 volts AC.
2. Compare test results to specifications.
  - a. If the output is below specifications, charging problem could be a faulty rotor or stator.
  - b. If output is good, charging problem might be faulty regulator/rectifier. Replace as required.
3. Check the output again as described under CURRENT AND VOLTAGE OUTPUT TEST on page 7-19.

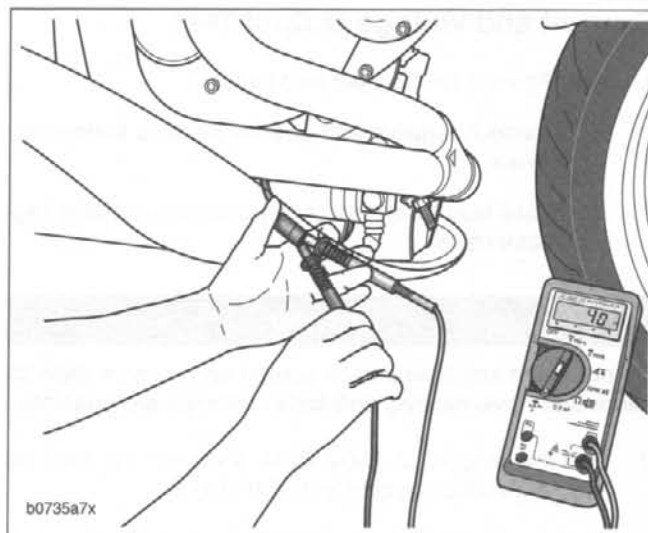


Figure 7-22. Check Stator AC Voltage Output

## REMOVAL/DISASSEMBLY

### WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Disconnect battery cables, negative cable first.
2. Remove primary cover. See 6.2 PRIMARY CHAIN.
3. Remove clutch assembly, primary chain and engine sprocket/rotor assembly as a unit. See 6.5 PRIMARY DRIVE/CLUTCH.
4. Remove/disassemble rotor and/or stator, as required. Refer to the following procedures.

### Rotor

1. See Figure 7-23. Remove the four bolts which secure alternator rotor to engine sprocket.
2. See Figure 7-24. Position blocking under rotor. Press sprocket free of rotor.

### NOTE

Resistance to sprocket/rotor disassembly is due in part to the magnetic force of the permanent rotor magnets.

### Stator

1. See Figure 7-25. Disconnect stator wiring (4) from voltage regulator wiring at connector (5) [46] near the oil pump.
2. Remove cable straps holding stator wire to oil filter hose.
3. Withdraw stator wiring (4) from behind the gearcase cover.
4. Remove and discard the four TORX screws (2) which secure stator (1) to left crankcase half.

### CAUTION

Stator TORX screws contain a thread locking compound. Do not reuse existing screws. Always use new screws with the proper thread locking compound. Loss of torque on TORX fasteners could result in alternator damage.

5. Remove stator wiring grommet (3) from left crankcase half.
6. Withdraw stator wiring (4) from grommet hole in left crankcase half. Remove stator (1).

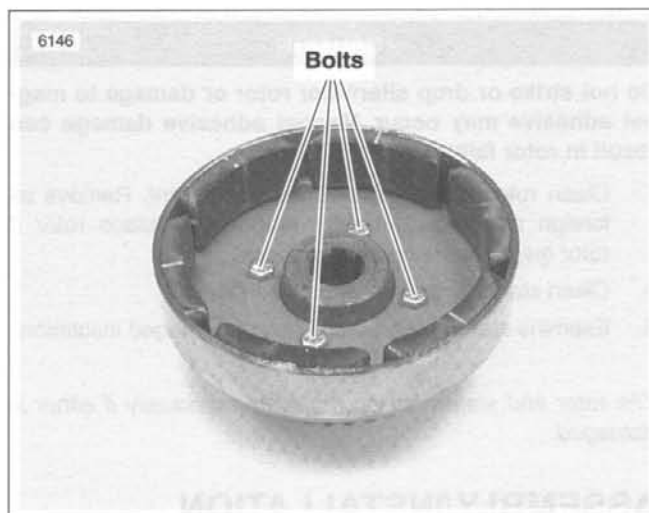


Figure 7-23. Rotor Assembly

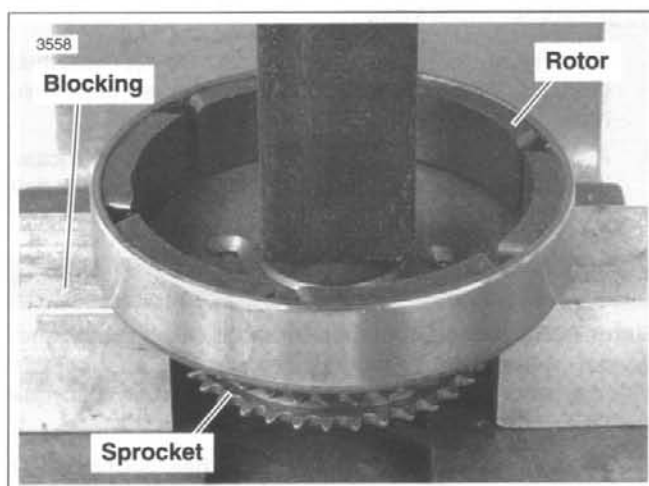


Figure 7-24. Removing Rotor From Sprocket

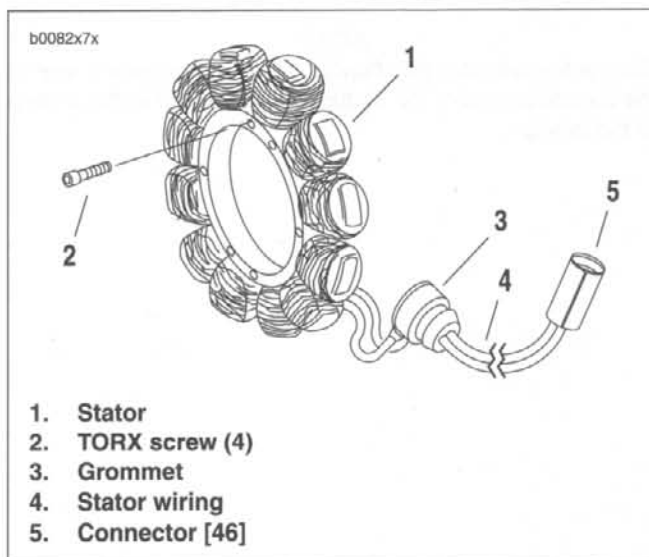


Figure 7-25. Stator Assembly



## CLEANING, INSPECTION AND REPAIR

### CAUTION

Do not strike or drop alternator rotor or damage to magnet adhesive may occur. Magnet adhesive damage can result in rotor failure.

1. Clean rotor with a petroleum-base solvent. Remove all foreign material from rotor magnets. Replace rotor if rotor magnets are cracked or loose.
2. Clean stator by wiping with a clean cloth.
3. Examine stator leads for cracked or damaged insulation.

### NOTE

The rotor and stator can be replaced individually if either is damaged.

## ASSEMBLY/INSTALLATION

Depending on whether the rotor, the stator, or both the rotor and stator were removed/disassembled, perform the applicable procedures which follow:

1. See Figure 7-25. Feed stator wiring (4) with attached grommet (3) into open grommet hole in left crankcase half.
2. Apply a light coating of clean engine oil or chaincase lubricant to grommet. Install grommet into hole in left crankcase half.

### CAUTION

Stator TORX screws contain a thread locking compound. Do not reuse existing screws. Always use new screws with the proper thread locking compound. Loss of torque on TORX fasteners could result in alternator damage.

3. Position stator (1) on left crankcase half. Secure stator using four new TORX screws (2). Tighten screws to 30-40 in-lbs (3.4-3.5 Nm).
4. Route stator wiring (4) in front of starter, behind gearcase cover and outboard of oil pump.

### NOTE

Temporarily attach a thin flexible "feed" or mechanic's wire to the connector end of the stator wiring to assist in the routing of the wiring.

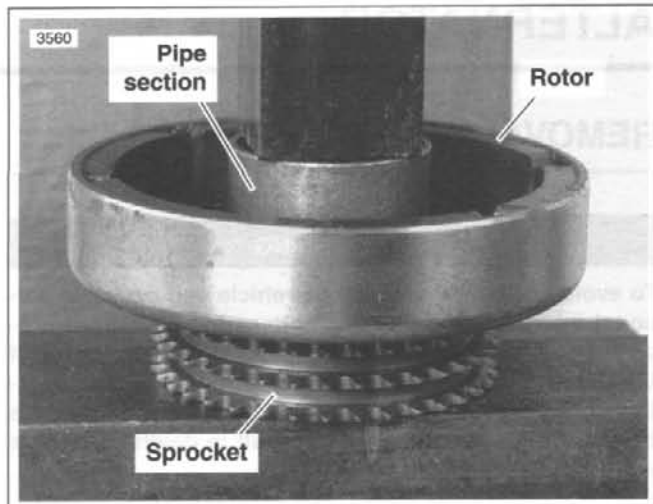


Figure 7-26. Pressing Rotor onto Sprocket

5. Connect alternator stator wiring to voltage regulator connector [46]. Bundle excess wiring in front of oil pump. Secure bundle to oil filter hose using a new cable strap.
6. See Figure 7-26. Attach rotor to sprocket.
  - a. Position rotor on sprocket. Align holes in sprocket with holes in rotor.
  - b. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of each mounting bolt. Insert the four mounting bolts through rotor and start bolts into tapped holes in sprocket.
  - c. Position a section of pipe with an inside diameter larger than the sprocket mounting hub over center of rotor. Press rotor onto sprocket. Tighten bolts to 90-110 in-lbs (10.2-12.4 Nm).
7. Install clutch assembly, primary chain and engine sprocket/rotor assembly as a unit. See 6.5 PRIMARY DRIVE/CLUTCH.
8. Install primary cover. See 6.2 PRIMARY CHAIN.

### WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

9. Connect battery cables, positive cable first.
10. Test charging system. See 7.6 CHARGING SYSTEM.

# VOLTAGE REGULATOR

7.8

## GENERAL

The voltage regulator is mounted to the front of the crankcase. The voltage regulator is not repairable. Replace the unit if it fails.

## REMOVAL

### ⚠ WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Disconnect battery cables, negative cable first.

### CAUTION

When disconnecting the alternator stator wiring, pull apart the connector by firmly grasping both connector halves. Do not pull on leads or damage to the wires and/or terminals may result.

2. See Figure 7-27. Locate voltage regulator connector [46] near the oil pump. Disconnect from alternator stator wiring. Cut cable straps if necessary.
3. Detach charging wire from main circuit breaker. See 7.24 FUSES AND CIRCUIT BREAKERS.
4. Remove screws (1), washers (2) and lockwasher (4).
5. Remove and discard voltage regulator (3).
6. If necessary, detach mounting bracket (5) by removing screws, washers and nuts.

## INSTALLATION

1. See Figure 7-28. Attach **new** voltage regulator (3) using screws (1) and washer (2). Place lockwasher (4) on gearcase cover side of mount.
2. Connect voltage regulator connector [46] to alternator stator wiring. Bundle excess wiring in front of oil pump. Secure bundle to oil pump using a **new** cable strap (6).
3. Route charging wire (8) to gold post on main circuit breaker. Secure wire to frame with **new** cable straps.

### ⚠ WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

4. Connect battery cables, positive cable first.
5. Test charging system. See 7.6 CHARGING SYSTEM.

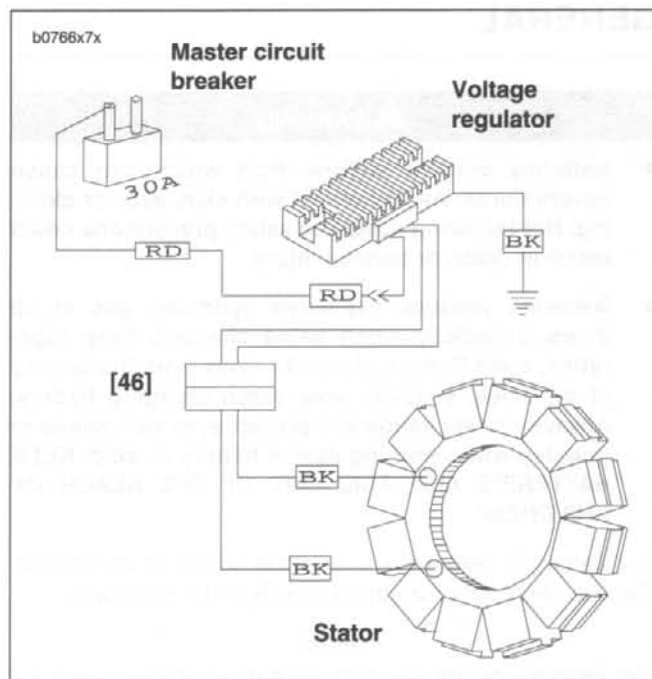


Figure 7-27. Voltage Regulator Connector [46]

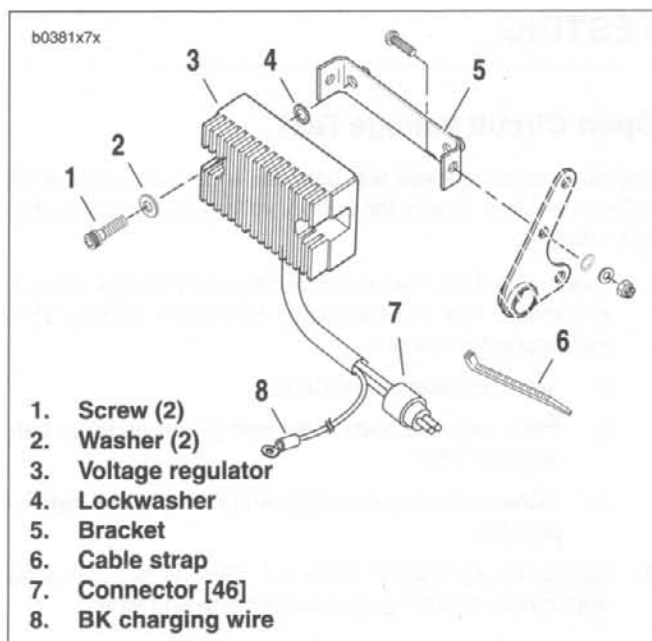


Figure 7-28. Voltage Regulator

# BATTERY (1999 MODELS)

7.9

## GENERAL

### ⚠ WARNING

- Batteries contain sulfuric acid which can cause severe burns. Avoid contact with skin, eyes or clothing. Not following adequate safety precautions could result in death or serious injury.
- Batteries produce explosive hydrogen gas at all times, especially when being charged. Keep cigarettes, open flame and sparks away from the battery at all times. Ventilate area when charging battery. Always protect hands and protect eyes with shield or goggles when working near a battery or acid. **KEEP BATTERIES AND ACID OUT OF THE REACH OF CHILDREN!**

The battery is below the seat in the center of the vehicle. Remove the battery from the right side of the motorcycle.

### NOTE

The battery requires no additional fluid at any time. See 1.4 BATTERY (1999 MODELS) for removal/installation procedures.

## TESTING

### Open Circuit Voltage Test

The open circuit voltage test provides a general indicator of battery condition. Check the battery voltage to make sure it is fully charged.

1. See Figure 7-29. Test open circuit battery voltage using a multimeter. It is not necessary to remove battery from motorcycle for this test.
  - a. Set multimeter to read VDC.
  - b. Place negative multimeter lead (1) on negative battery post (2).
  - c. Place positive multimeter lead (3) on positive battery post (4).
2. Check results against Table 7-1. Charge battery using appropriate charger output current rate and time.

### NOTE

Charging rates are for a constant current charger @ 1.8 amps. Tapered-rate chargers or trickle chargers will require longer charging times.

If the battery reads below 12.8 VDC after 10 hours of charging using a constant rate charger (set at 1.8 amps), replace the battery.

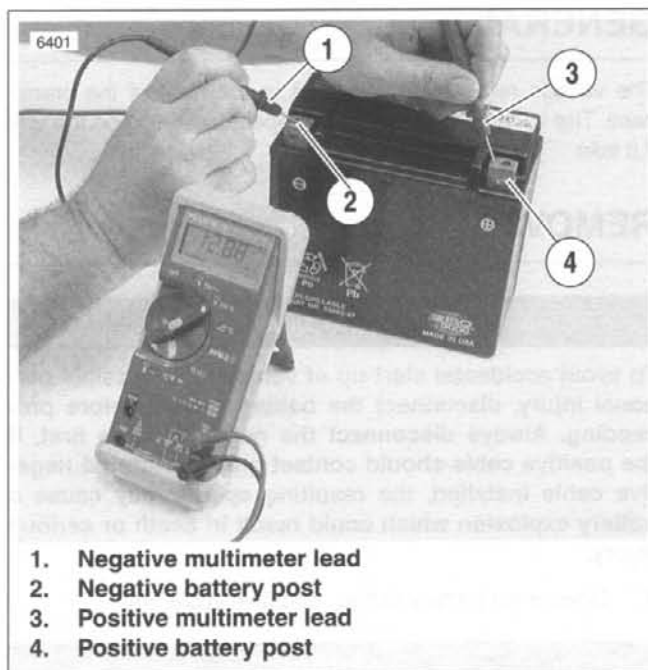


Figure 7-29. Open Circuit Voltage Test

Table 7-1. Charging Rates

VOLTAGE READING	STATE OF CHARGE	ACTION
13.0 VDC	100%	None
12.8 VDC	75%	Charge 3-5 hours (see note)
12.5 VDC	50%	Charge 4-7 hours (see note)
12.2 VDC	25%	Charge 10 hours (see note)

## Load Test

The load test measures battery performance under full current load and is the best indicator of battery condition.

### CAUTION

Fully charge the battery before testing. If battery is not fully charged, test readings will be incorrect.

1. Remove battery from motorcycle and fully charge. See CHARGING BATTERY.
2. See Figure 7-31. Connect BATTERY/CHARGING SYSTEM LOAD TESTER (Part No. HD-42376).
  - a. Attach tester leads to battery posts.
  - b. Place induction pickup over negative (black) cable.
3. Load battery to three times amp hour rating. The 18 amp-hour battery should be loaded to three times its amp-hour rating, or 54 amps, for 15 seconds.
4. Observe voltage reading.
  - a. Voltage reading throughout the test should be 9.6 VDC or more at 70°F (21° C).
  - b. If voltage reading is below 9.6 VDC, charge battery.

## CHARGING BATTERY

### WARNING

Always unplug or turn battery charger OFF before connecting or disconnecting charger clamps from battery. Connecting or disconnecting clamps with charger ON could cause a spark and a possible battery explosion which could result in death or serious injury.

### CAUTION

Never add water to the maintenance free battery and never remove the seal strip on top of the battery. Never allow a battery to stand in a discharged condition or damage to the battery will occur.

1. Remove battery from motorcycle and place battery on a level surface. See REMOVAL.

### CAUTION

Refer to the charging instructions on the top of the battery. Do not reverse the charger connections described in the next step, or the charging system of the motorcycle could be damaged.

2. With charger turned OFF, attach battery.
  - a. Connect red charger lead to positive terminal.
  - b. Connect black charger lead to negative terminal.
3. Turn battery charger ON. Charge battery for time shown in Table 7-1. Check open circuit battery voltage when battery has finished charging.

### NOTE

If battery gets hot, over 110°F (44°C) (warm to the touch), discontinue charging and let battery cool down.

## WARNING - EXPLOSIVE GASES

Cigarettes, flames or sparks could cause battery to explode which could result in death or serious injury. Always shield eyes and face from battery. Do not charge without proper instruction and training. Securely connect cables to the proper terminals.

## POISON - CAUSES SEVERE BURNS

Contains sulfuric acid. Avoid contact with skin, eyes, and clothing. In event of accident, flush with water and call a physician immediately.

## KEEP OUT OF REACH OF CHILDREN

Figure 7-30. Battery Warnings

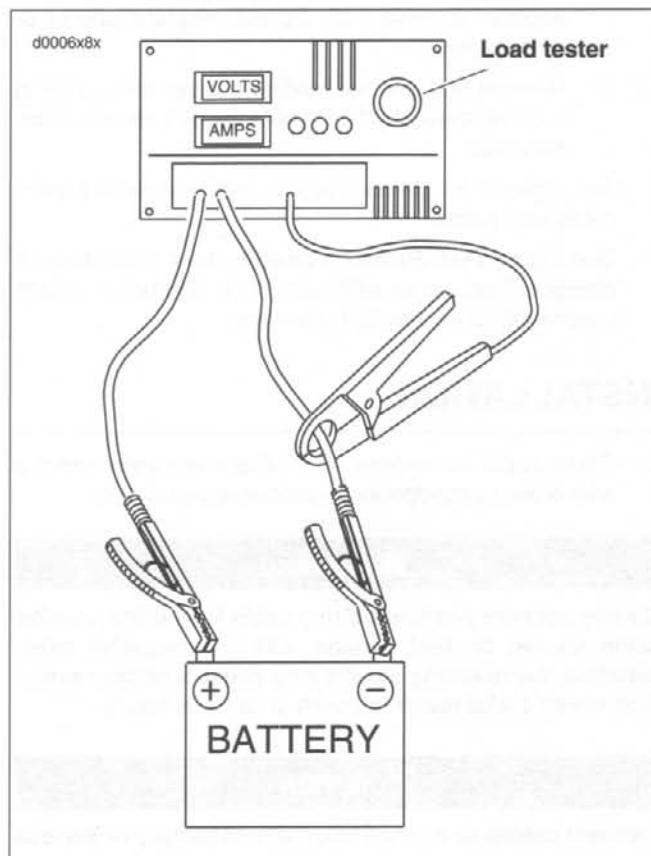


Figure 7-31. Load Test

## REMOVAL

### **WARNING**

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. See Figure 7-32. Disconnect cables (5, 10) from battery, negative cable (5) first.
  - a. Remove bolt (metric) holding negative cable (5) to negative terminal (12). Do not misplace spacer or terminal nut.
  - b. Remove bolt (metric) holding positive cable (10) to positive terminal (13). Do not misplace spacer or terminal nut.
2. See Figure 7-33. Remove bolt to detach negative battery cable from frame.
3. See Figure 7-34. Remove protective boot from starter if present. Remove nut with washer (1) (metric) to detach positive battery cable (2) from starter.

## INSTALLATION

1. Clean cable connectors and battery terminals using a wire brush or sandpaper to remove any oxidation.

### **WARNING**

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

### **CAUTION**

Connect cables to correct terminals of battery or serious damage to motorcycle electrical system will occur.

2. Connect cables to battery.
  - a. See Figure 7-32. Positive battery cable (10) runs from starter to positive battery terminal.
  - b. Connect positive cable (10) to positive (+) battery terminal (13) using bolt (metric), spacer and nut.
  - c. Connect negative cable (5) to negative (-) battery terminal (12) using bolt (metric), spacer and nut.
  - d. Tighten bolts to 40 in-lbs (4.5 Nm).

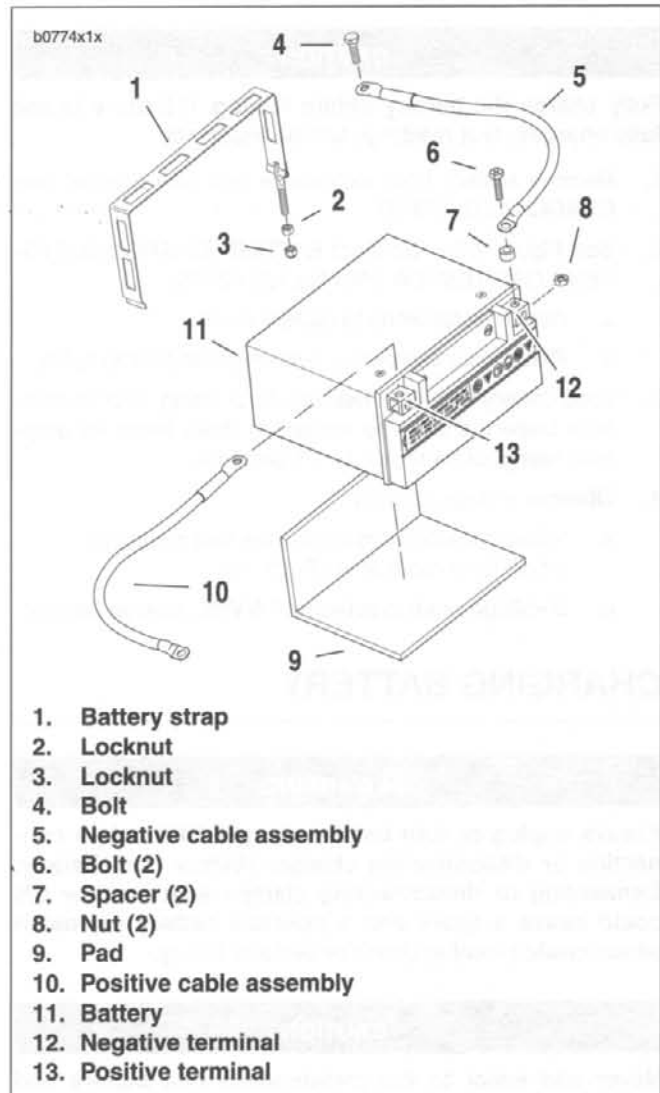


Figure 7-32. Battery

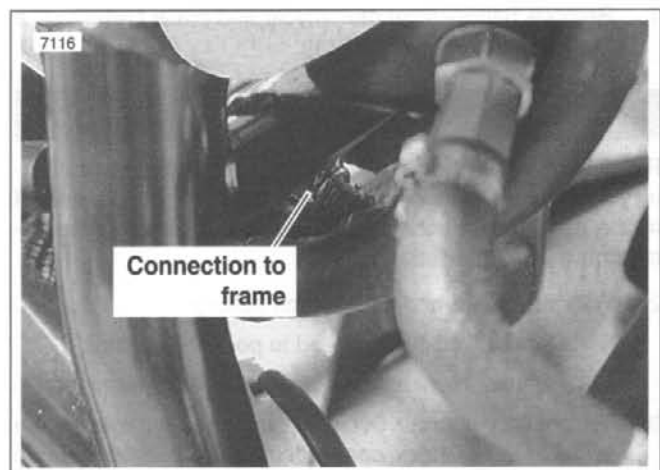
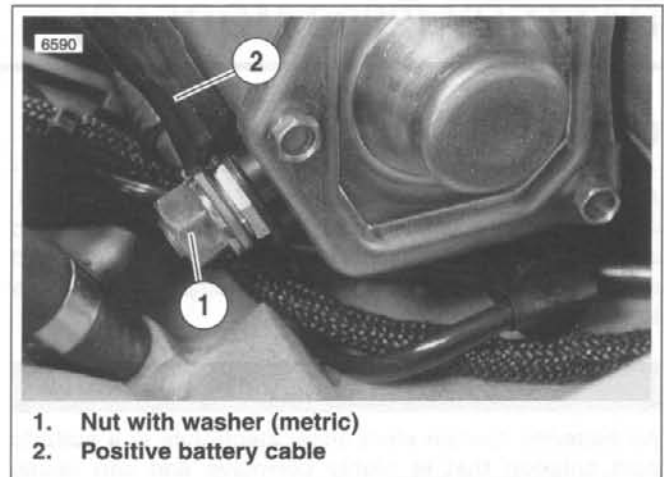


Figure 7-33. Negative Battery Cable

3. Connect cables to frame and starter.
  - a. See Figure 7-34. First, connect positive cable to starter using nut with washer (metric). Tighten to 60-85 **in-lbs** (6.8-9.6 Nm).
  - b. See Figure 7-33. Attach negative cable to frame below oil tank.
4. Apply light coat of petroleum jelly or corrosion-retardant material to both battery terminals.



**Figure 7-34. Positive Battery Cable  
(Protective Boot Not Shown)**



## GENERAL

All 2000 Model Year Buell batteries are permanently sealed, maintenance-free, valve-regulated, lead/calcium and sulfuric acid batteries. The batteries are shipped pre-charged and ready to be put into service. Do not attempt to open these batteries for any reason.

### ⚠ WARNING

All batteries contain electrolyte. Electrolyte is a sulfuric acid solution that is highly corrosive and can cause severe chemical burns. Avoid contact with skin, eyes, and clothing. Avoid spillage. Always wear protective face shield, rubberized gloves and protective clothing when working with batteries. A warning label is attached to the top of the battery. See Figures 7-34 and 7-35. Never remove warning label from battery. Failure to read and understand all precautions contained in warning label before performing any service on batteries could result in death or serious injury.

## BATTERY TESTING

### Voltmeter Test

See Table 7-5. The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.8V or above, perform the load test described on page 7-30.



Figure 7-34. Maintenance-Free AGM Battery

### ANTIDOTE

External	–	Flush with water.
Internal	–	Drink large quantities of milk or water, followed by milk of magnesia, vegetable oil or beaten eggs. Call doctor immediately.
Eyes	–	Flush with water, get immediate medical attention.

**Contents are Corrosive.**

**Wear Safety Glasses.**

**Contents are Explosive.**

**Keep Flames Away.**

**Read Instructions.**

**Keep Away From Children.**

**NON-SPILLABLE**

This is a ready filled, activated, SEALED BATTERY. NEVER remove strip. Refer to owner's manual for charging instructions.

If battery is put into service after date shown, charge for minimum of 1 hour at 6-10 amps. (See side of battery for date.)

**⚠ DANGER/POISON**

**SHIELD EYES.**  
**EXPLOSIVE GASES CAN CAUSE BLINDNESS OR INJURY.**

**NO SPARKS FLAMES SMOKING**

**SULFURIC ACID CAN CAUSE BLINDNESS OR SEVERE BURNS.**

**FLUSH EYES IMMEDIATELY WITH WATER. GET MEDICAL HELP FAST.**

3-4425

**KEEP OUT OF REACH OF CHILDREN. DO NOT OPEN BATTERY.**

f1733x8x

Figure 7-35. Battery Warning Label

**Table 7-5. Voltmeter Test**

BATTERY CHARGE CONDITIONS	
Voltage (OCV)	State of Charge
12.8	100%
12.6	75%
12.3	50%
12.0	25%
11.8	0%

## DISCONNECTION AND REMOVAL

1. Remove seat. See SEAT.

### WARNING

Always disconnect the negative battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion that could result in death or serious injury.

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal.
4. Remove battery strap locknut (metric). Unhook battery strap from frame near negative terminal.
5. Cut any cable straps holding oxygen sensor connector to battery.
6. Remove battery from right side.

## CLEANING AND INSPECTION

1. Battery top must be clean and dry. Dirt and electrolyte on top of the battery can cause battery to self-discharge. Clean battery top with a solution of baking soda (sodium bicarbonate) and water (5 teaspoons baking soda per quart or liter of water). When the solution stops bubbling, rinse off the battery with clean water.
2. Clean cable connectors and battery terminals using a wire brush or sandpaper. Remove any oxidation.
3. Inspect the battery screws, clamps and cables for breakage, loose connections and corrosion. Clean clamps.
4. Check the battery posts for melting or damage caused by overtightening.
5. Inspect the battery for discoloration, raised top or a warped or distorted case, which might indicate that the battery has been frozen, overheated or overcharged.
6. Inspect the battery case for cracks or leaks.

## BATTERY CHARGING

### Safety Precautions

Never charge a battery without first reviewing the instructions for the charger being used. In addition to the manufacturer's instructions, follow these general safety

precautions:

- Always wear proper eye, face and hand protection.
- Always charge batteries in a well-ventilated area.
- Turn the charger "OFF" before connecting the leads to the battery to avoid dangerous sparks.
- Never try to charge a visibly damaged or frozen battery.
- Connect the charger leads to the battery; red positive (+) lead to the positive (+) terminal and black negative (-) lead to the negative (-) terminal. If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure that the ignition and all electrical accessories are turned off.
- Make sure that the charger leads to the battery are not broken, frayed or loose.
- If the battery becomes hot, or if violent gassing or spewing of electrolyte occurs, reduce the charging rate or turn off the charger temporarily.
- Always turn the charger "OFF" before removing charger leads from the battery to avoid dangerous sparks.

### Charging Battery

Charge the battery if any of the following conditions exist:

- Vehicle lights appear dim.
- Electric starter sounds weak.
- Battery has not been used for an extended period of time.

### WARNING

Charge the battery in a well ventilated area. Explosive hydrogen gas escapes from the battery during charging. Keep open flames, electrical sparks and smoking materials away from the battery at all times. Inadequate safety precautions could result in death or serious injury.

### CAUTION

If the battery releases an excessive amount of gas during charging, decrease the charging rate. If the battery gets hotter than 110°F. (43°C) during charging, discontinue charging and allow the battery to cool. Overheating may result in plate distortion, internal shorting, dryout or other damage.

1. Perform a voltmeter test to determine the state of charge. See BATTERY TESTING, VOLTMETER TEST, on the previous page. If battery needs to be charged, proceed to step 2.

### CAUTION

Always remove the battery from the motorcycle before charging. Accidental electrolyte leakage will damage motorcycle parts.

**Table 7-6. Battery Charging Rates/Times**

Battery Amp-Hour	State of Charge		3 Amp Charger	6 Amp Charger	10 Amp Charger	20 Amp Charger
	Voltage Reading	% of Charge				
SPORT 19	12.8 V	100%	-	-	-	-
	12.6 V	75%	1.75 hours	50 minutes	30 minutes	15 minutes
	12.3 V	50%	3.5 hours	1.75 hours	1 hour	30 minutes
	12.0 V	25%	5 hours	2.5 hours	1.5 hours	45 minutes
	11.8 V	0%	6 hours, 40 minutes	3 hours, 20 minutes	2 hours	1 hour

The figures listed above assume that the battery is charging at room temperature. If warmer than room temperature, use a slightly shorter charging time. If colder, use a slightly longer charging time.

The use of constant current chargers to charge sealed maintenance-free batteries is not recommended. Any overcharge will cause dry-out and premature battery failure. If a constant current charger is the only type available, do **not** exceed the charge times listed above and do **not** continue charging the battery if it gets hot. When charging, never exceed 15 volts for more than 30 minutes.

- Remove the battery from the motorcycle. See BATTERY, DISCONNECTION AND REMOVAL. Place the battery on a level surface.

- Perform a load test to determine the condition of the battery. See BATTERY TESTING, LOAD TEST, on this page.

### WARNING

Always unplug or turn OFF the battery charger before connecting the charger clamps to the battery. Connecting clamps with the charger ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

### CAUTION

Do not reverse the charger connections described in the following steps or the charging system of the motorcycle could be damaged.

- Connect the red battery charger lead to the positive (+) terminal of the battery.
- Connect the black battery charger lead to the negative (-) terminal of the battery.

### NOTE

If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure that the ignition and all electrical accessories are turned off.

- Step away from the battery and turn on the charger. See the charging instructions in Table 7-6.

### WARNING

Always unplug or turn OFF the battery charger before disconnecting the charger clamps from the battery. Disconnecting clamps with the charger ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

- After the battery is fully charged, disconnect the black battery charger lead to the negative (-) terminal of the battery.
- Disconnect the red battery charger lead to the positive (+) terminal of the battery.
- Mark the charging date on the battery.

## BATTERY TESTING

### Load Test

The load test measures battery performance under full current load and is the best indicator of battery condition. To load test the battery, proceed as follows:

### CAUTION

Load testing a discharged battery can result in permanent battery damage.

- Always fully charge the battery before testing or test readings will be incorrect. See CHARGING BATTERY. Load testing a discharged battery can also result in permanent battery damage.
- After charging, allow battery to stand for at least one hour before testing.

### WARNING

Always turn the battery load tester OFF before connecting the tester cables to the battery terminals. Connecting tester cables with the load tester ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

- Connect tester leads to battery posts and place induction pickup over negative (black) cable. See Figure 7-36.

### CAUTION

To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds.

- Referencing Table 7-7, load battery at 50% of CCA rating using the load tester. Voltage reading after 15 seconds should be 9.6V or more at 70°F. (21°C).

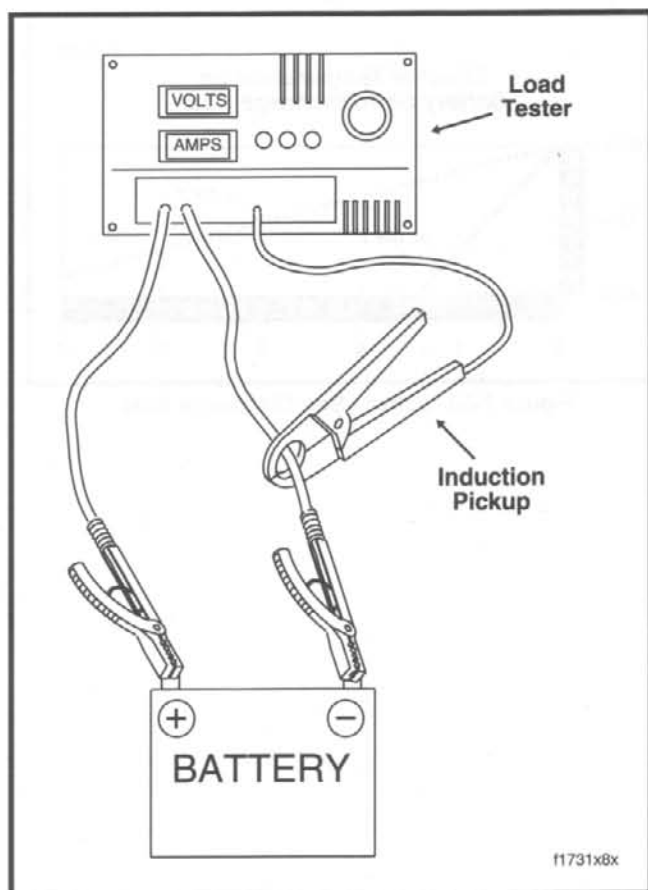


Figure 7-36. Load Test Battery

### WARNING

Always turn the battery load tester OFF before disconnecting the tester cables from the battery terminals. Disconnecting tester cables with the load tester ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

5. Install the battery on the motorcycle. See BATTERY, INSTALLATION AND CONNECTION.

Table 7-7. Battery Load Test

COLD CRANKING AMPERAGE (CCA)	100%	50%
SPORT	270	135

## BATTERY CABLE ROUTING

Positive battery cable runs from starter post to positive battery terminal. Negative battery cable runs from frame to negative battery terminal. See Figure 7-37.

## BATTERY INSTALLATION AND CONNECTION

1. Place the fully charged battery into the battery box, terminal side forward.

### CAUTION

Connect the cables to the correct battery terminals or damage to the motorcycle electrical system will occur.

### WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion that could result in death or serious injury.

### CAUTION

Overtightening bolts can damage battery terminals.

2. Insert bolt through battery positive cable (red) into threaded hole of battery positive (+) terminal. Tighten bolt to 60-96 in-lbs (6.8-10.9 Nm).
3. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 in-lbs (6.8-10.9 Nm).
4. Apply a light coat of petroleum jelly or corrosion retardant material to both battery terminals.
5. Install battery strap.
  - a. Insert tab on right side of battery tray. Place battery strap around top side of battery.
  - b. Hook edge of strap into frame tab.
  - c. Insert threaded shaft on strap through frame tab.
  - d. Install battery strap locknut on threaded shaft. Tighten to 40 in-lbs (4.5 Nm).
5. Apply light coat of petroleum jelly or corrosion-retardant material to both battery terminals.
6. Secure oxygen sensor connector with new cable straps.
6. Install seat. See SEAT, INSTALLATION, Section 2.

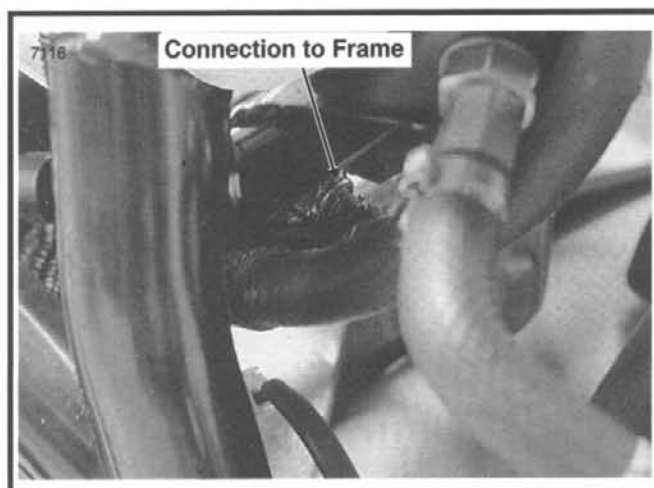


Figure 7-37. Negative Battery Cable

## STORAGE

### WARNING

Always store batteries where they cannot be reached by children. Contact with the battery's sulfuric acid could result in death or serious injury.

### CAUTION

The electrolyte in a discharged battery will freeze if exposed to freezing temperatures. Freezing may crack the battery case and buckle battery plates.

If the motorcycle will not be operated for several months, such as during the winter season, remove the battery from the motorcycle and fully charge. See CHARGING BATTERY.

Self-discharge is a normal condition and occurs continuously at a rate that depends on the ambient temperature and the battery's state of charge. Batteries discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool (not freezing), dry place. See Figure 7-38.

Charge the battery every month if stored at temperatures below 60° F. (16° C). Charge the battery more frequently if stored in a warm area above 60° F. (16° C).

### NOTE

The H-D Battery Tender Automatic Battery Charger (P/N 99863-93TA) may be used to maintain battery charge for extended periods of time without risk of overcharging or boiling.

When returning a battery to service after storage, refer to the instructions under CHARGING BATTERY.

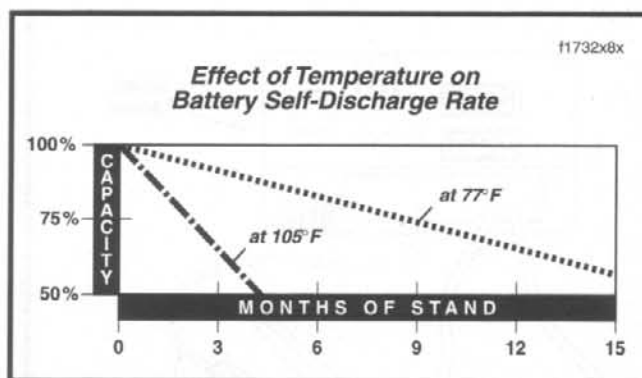


Figure 7-38. Battery Self-Discharge Rate



## Battery Stocking and Selling

All Buell dealers should maintain a fresh stock of batteries by rotating and selling them on a "first in, first out" basis. All batteries must be sold within 12 months of the date code which appears on a round sticker below the warranty tag on the left side of the battery (positive terminal side). See Figure 7-39.

The date code sticker consists of both an alpha and numeric character that indicates the date the battery was manufactured. While the alpha character signifies the month, the numeric character indicates the year. Looking at the date code sticker at the bottom of Figure 1, we can see that the battery was manufactured in August, 1999.

BATTERY DATE CODE			
Alpha Character	Month	Numeric Character	Year
A	January	8	1998
B	February	9	1999
C	March	0	2000
D	April	1	2001
E	May	2	2002
F	June		
G	July		
H	August		
J	September		
K	October		
L	November		
M	December		

When a new battery is sold from stock, the battery must also be made to reflect the date of sale. To accomplish this, peel off both the month and year on the right side of the warranty tag.

If the date of sale occurs after the 15th day of the month, advance the date to the next month. For example, if the battery is sold on July 22, peel off the month of August, which is abbreviated on the tag as "AU." To determine the correct number to peel off for the year, just reference the last digit of the current year. Therefore, the number "9" is peeled off to signify the year 1999.

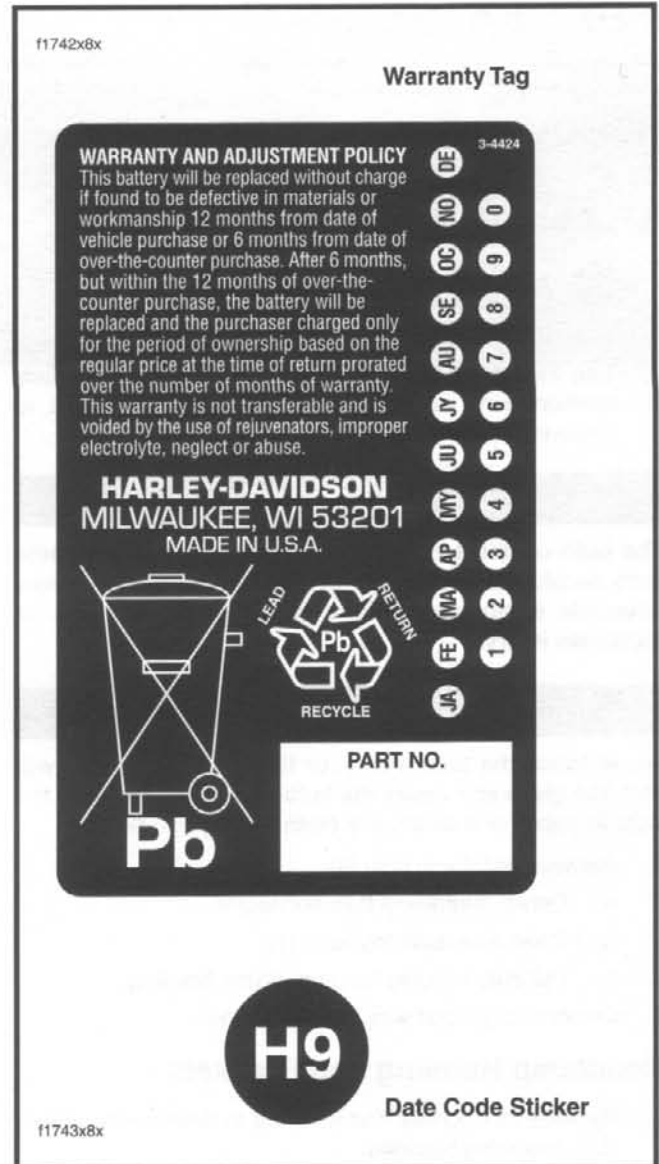


Figure 7-39. Warranty Tag/Date Code Stickers

## REMOVAL

### Headlamp Bulb

1. See Figure 7-40. Loosen screw (9) at bottom of headlamp.
2. Pry headlamp (8) from headlamp housing (12).
3. See Figure 7-41. Press retaining clip (4) and remove position lamp bulb (3) from headlamp. Twist bulb to remove from harness.

### CAUTION

The bulb contains Halogen gas under pressure. Handle bulb careful and wear eye protection. Failure to follow adequate safety precautions could result in minor or moderate injury.

### CAUTION

Never touch the bulb with your fingers. Fingerprints will etch the glass and cause the bulb to fail. Always wrap the bulb in paper or a clean, dry cloth during handling.

4. Remove headlamp bulb (6).
  - a. Detach headlamp bulb connector.
  - b. Open wire retaining latch (1).
  - c. Pull bulb housing from headlamp housing.
5. Disconnect ground wire from headlamp.

### Headlamp Housing and Brackets

1. Remove four screws and washers to detach windscreen from mounting brackets.

### WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (49 psi [338 kPa]). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before attaching fuel pressure gauge. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

2. Purge fuel line and remove fuel tank. See 4.34 FUEL TANK.
3. See Figure 7-42. Cut as many cable straps as necessary to access headlamp connector [38] along right side frame tube. Detach connector [38] from wiring harness.
4. See Figure 7-40. Remove screw (1) (metric) and washer (2) on each side.
5. Remove headlamp housing from vehicle.
6. Remove headlamp brackets.
  - a. Remove front turn signals. See 7.14 TURN SIGNALS.
  - b. Remove four bolts (3) from weldnuts.
  - c. Remove front forks and headlamp brackets (4). See 2.24 FRONT FORK.

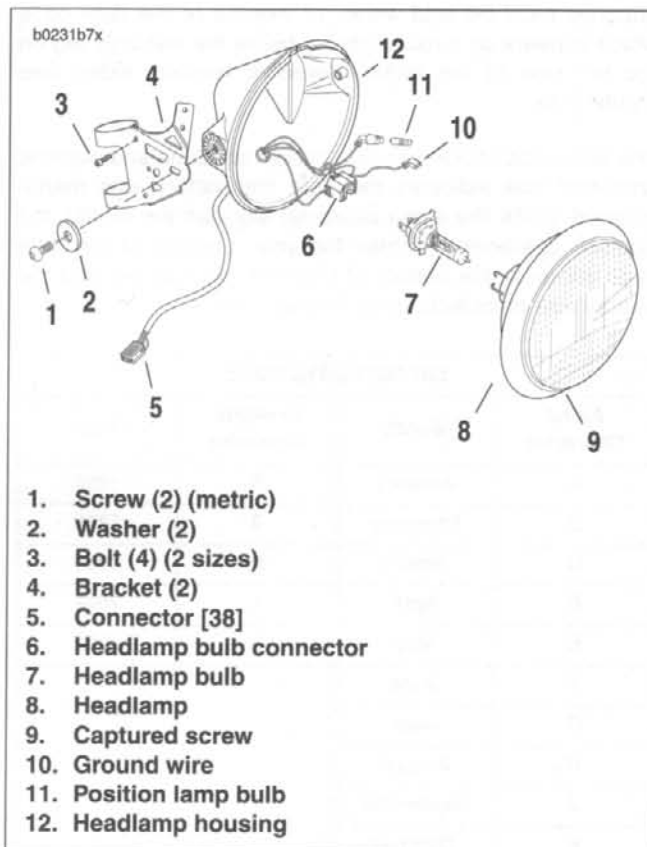


Figure 7-40. Headlamp Assembly

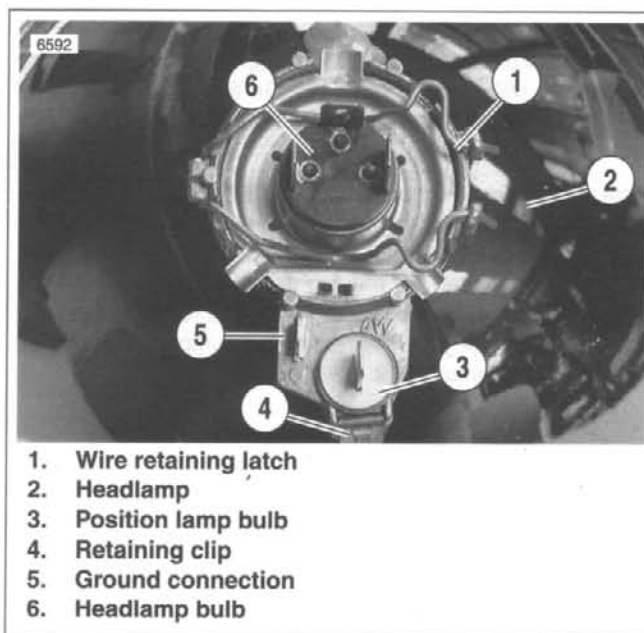


Figure 7-41. Headlamp Bulbs

## INSTALLATION

### Headlamp Bulb

#### CAUTION

The bulb contains Halogen gas under pressure. Handle bulb carefully and wear eye protection. Failure to follow adequate safety precautions could result in minor or moderate injury.

#### CAUTION

Never touch the bulb with your fingers. Fingerprints will etch the glass and cause the bulb to fail. Always wrap the bulb in paper or a clean, dry cloth during handling.

1. See Figure 7-41. Install headlamp bulb (6).
  - a. Align tabs on bulb housing with tabs on headlamp. Insert bulb.
  - b. Close the wire retaining latch (1).
  - c. Connect the headlamp bulb connector.

#### NOTE

When replacement is required, see your Buell dealer. Not using the specified bulb may cause charging system problems.

2. Insert position lamp bulb (3).
3. Connect ground wire (5).
4. See Figure 7-40. Place headlamp assembly in housing (12). Tighten screw (9).

#### WARNING

Check for proper headlamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper headlamp operation could result in death or serious injury.

5. Check headlamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.
  - a. Turn ignition key switch to IGN.
  - b. See Figure 7-43. Check headlamp LOW (2) and HIGH beam (1) settings.
  - c. Set headlamp to LOW beam (2). Press passing lamp switch (3). Headlamp should flash HIGH beam for as long as the switch is pressed.
  - d. Turn ignition key switch to OFF.
6. Align headlamp. See 1.25 HEADLAMP.

### Headlamp Housing and Brackets

1. Install headlamp brackets.
  - a. Install front forks through triple clamps and headlamp brackets. See 2.24 FRONT FORK.
  - b. See Figure 7-40. Install four bolts (3).
  - c. Attach front turn signals. See 7.14 TURN SIGNALS.
2. See Figure 7-42. Route headlamp wire harness between front forks and along right side frame tube. Attach connector [38] to wiring harness. Fasten wiring harness to frame with **new** cable straps.

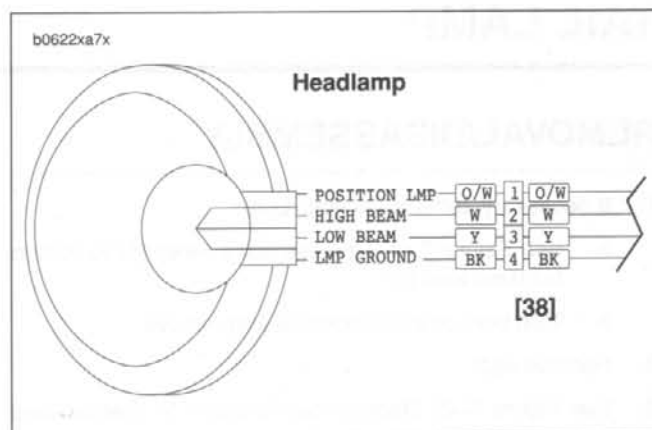


Figure 7-42. Headlamp Connector [38]

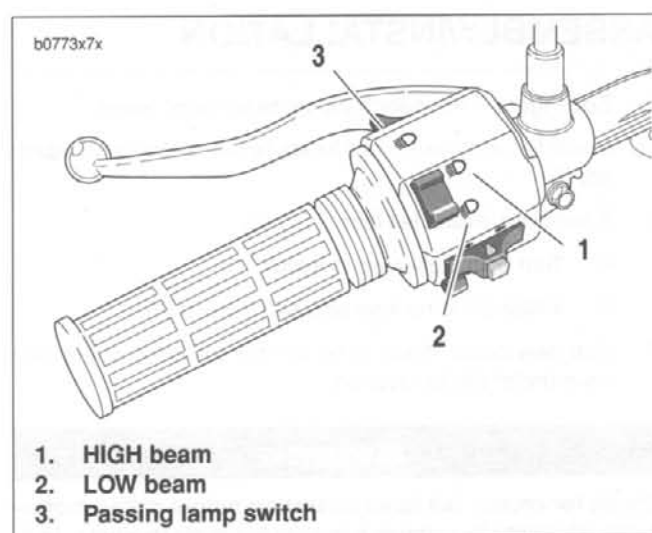


Figure 7-43. Headlamp Controls

3. See Figure 7-40. Install headlamp housing using two screws (1) (metric) and washers (2). Tighten to 6-8 ft-lbs (8.1-10.8 Nm).

#### WARNING

Check for proper headlamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper headlamp operation could result in death or serious injury.

4. Check headlamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.

#### WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

5. Install fuel tank and seat.
6. Align headlamp. See 1.25 HEADLAMP.



## REMOVAL/DISASSEMBLY

1. If necessary, remove tail lamp bulb.
  - a. See Figure 7-44. Remove two screws (1) to detach tail lamp lens (2).
  - b. Turn bulb counterclockwise and remove.
2. Remove seat.
3. See Figure 7-45. Remove two locknuts (6) (metric) and washers (5) from within trunk.
4. Disconnect the three terminals and remove tail lamp.

## ASSEMBLY/INSTALLATION

1. See Figure 7-45. Attach the three tail lamp wires.
2. Install tail lamp using two locknuts (6) (metric) and washers (5).
3. If removed, install tail lamp bulb (3).
  - a. Turn bulb clockwise to install.
  - b. Install tail lamp lens with two screws (1).
4. Use **new** cable straps to bundle the tail lamp wiring harness under the tail section.

### WARNING

Check for proper tail lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper lamp operation could result in death or serious injury.

5. Check tail lamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.
  - a. Turn ignition key switch to IGN.
  - b. Check for tail lamp illumination.
  - c. Squeeze front brake hand lever. Check for brake lamp illumination. Release front brake hand lever.
  - d. Press rear brake pedal. Check for brake lamp illumination. Release rear brake pedal.
  - e. Turn ignition key switch to OFF.

### WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

6. Install seat.

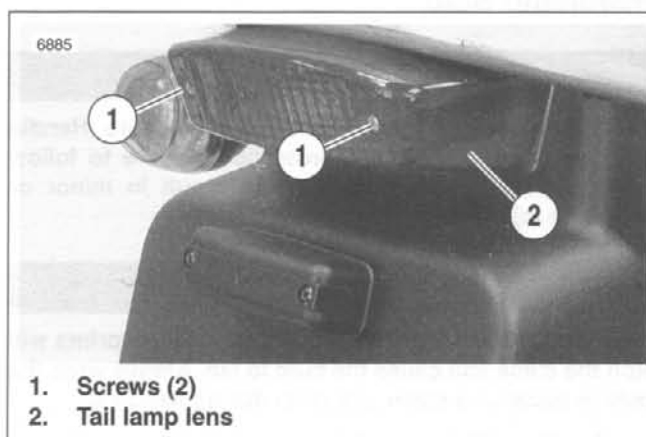


Figure 7-44. Turn Signal Lens

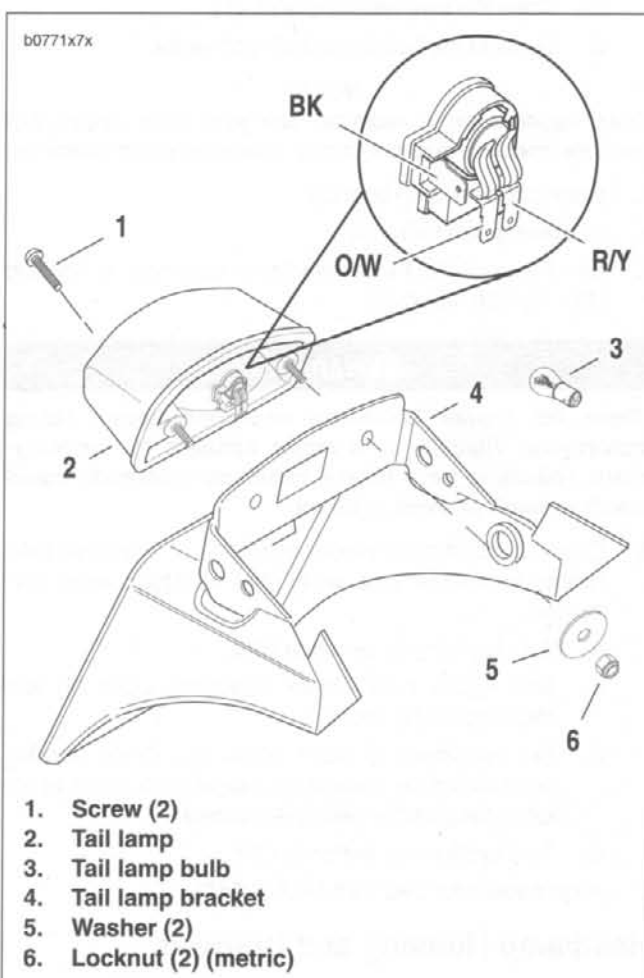


Figure 7-45. Tail Lamp

# TURN SIGNALS

7.14

## REMOVAL

### Bulbs

Remove screw on back of housing to access turn signal bulbs.

### Front

1. Remove windscreen and headlamp. See 7.12 HEADLAMP.
2. See Figure 7-46. Disconnect bullet connectors on turn signal wires.
3. See Figure 7-47. Remove nut (1) and lockwasher (2) from mounting bracket (3).
4. Remove turn signals (4) and standoffs (5).
5. Pull bullet connectors (6) and wiring through hole in mounting bracket (3).

### Rear

1. Remove trunk. See 2.45 TRUNK.
2. Cut cable straps to access bullet connectors under tail section.
3. See Figure 7-48. Disconnect bullet connectors on turn signal wires.
4. See Figure 7-49. Remove nut (1) and lockwasher (2).
5. Remove turn signal (3) from outside of trunk.

## INSTALLATION

### Front

1. See Figure 7-47. Insert bullet connectors (6) through hole in mounting bracket (3).
2. Install turn signal (4) and standoffs (5) using lockwasher (2) and nut (1). Tighten to 25-28 in-lbs (2.8-3.2 Nm).
3. Attach bullet connectors on turn signal wires as shown in Figure 7-46.
4. Install and align headlamp. See 7.12 HEADLAMP.

### WARNING

Check for proper turn signal operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper turn signal operation could result in death or serious injury.

5. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
  - a. Turn ignition key switch to IGN.
  - b. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
  - c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
  - d. Turn ignition key switch to OFF.

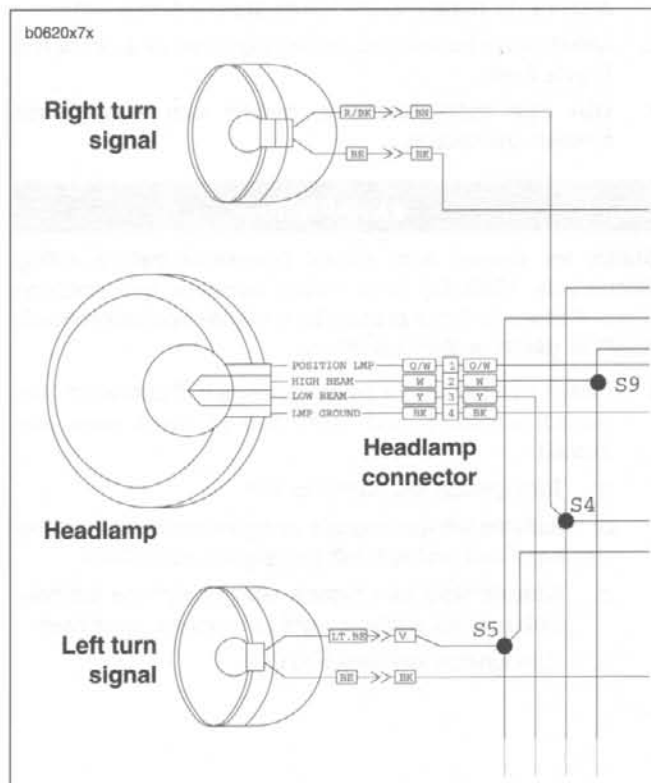


Figure 7-46. Front Turn Signal Connections

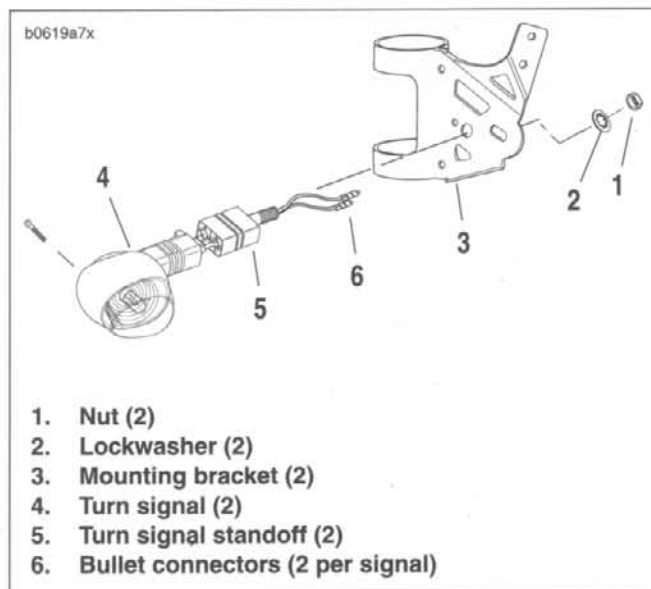


Figure 7-47. Front Turn Signals

## Rear

1. See Figure 7-49. Insert bullet connectors through rear hole in trunk. Attach turn signal (3) using lockwasher (2) and nut (1). Tighten to 96-120 in-lbs (10.8-13.6 Nm).
2. Attach bullet connectors on turn signal wires as shown in Figure 7-48.
3. Use **new** cable straps to bundle turn signal wires beneath tail section.

### WARNING

**Check for proper turn signal operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper turn signal operation could result in death or serious injury.**

4. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
  - a. Turn ignition key switch to IGN.
  - b. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
  - c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
  - d. Turn ignition key switch to OFF.

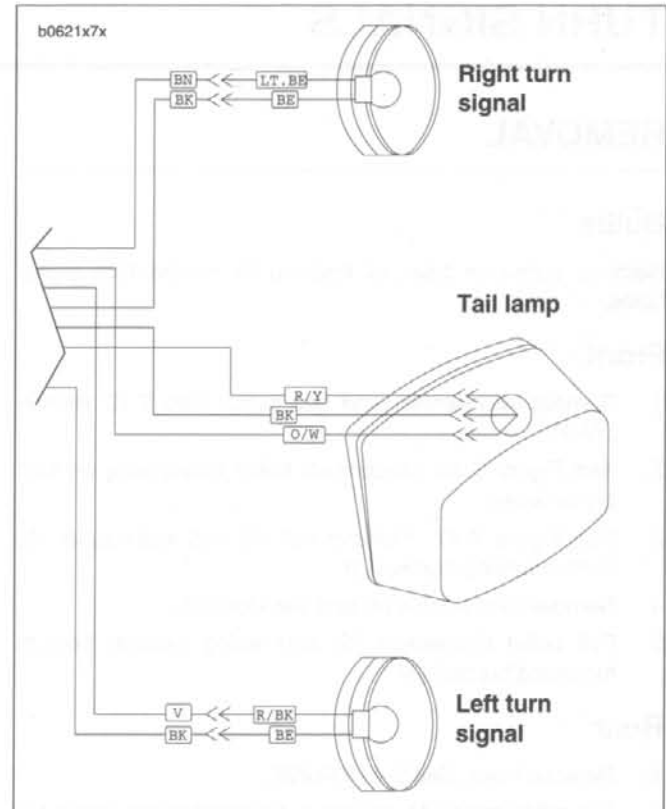


Figure 7-48. Rear Turn Signal Connections

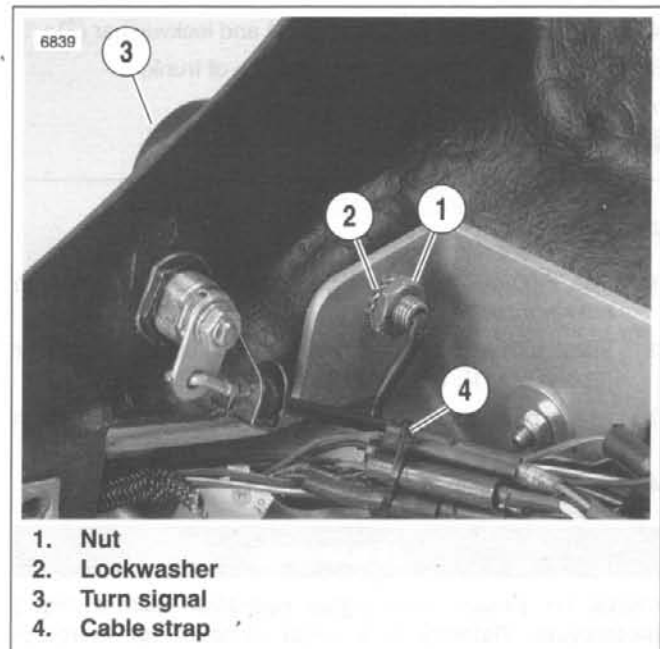


Figure 7-49. Rear Turn Signals

# TURN SIGNAL FLASHER

7.15

## MODEL YEAR CHANGE

The turn signal flasher has been relocated under the seat on all 2000 Model Buell X1 motorcycles.

## REMOVAL

### NOTE

The turn signal flasher is not repairable. Replace flasher upon failure.

1. See Figure 7-50. Remove nut (1) to free flasher (2) from bottom of ECM bracket.
2. Detach 3-place connector (3) [30] from flasher body.

## INSTALLATION

1. See Figure 7-50. Attach 3-place connector (3) [30] to flasher.
2. Install nut (1) to secure flasher (2) to bottom of ECM bracket.

### WARNING

Check for proper turn signal operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper turn signal operation could result in death or serious injury.

3. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
  - a. Turn ignition key switch to IGN.
  - b. See Figure 7-51. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
  - c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
  - d. Turn ignition key switch to OFF.

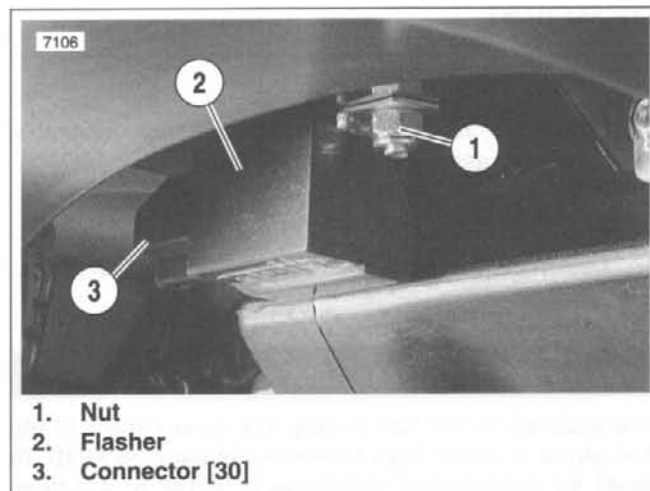


Figure 7-50. Turn Signal Flasher (1999 Shown)

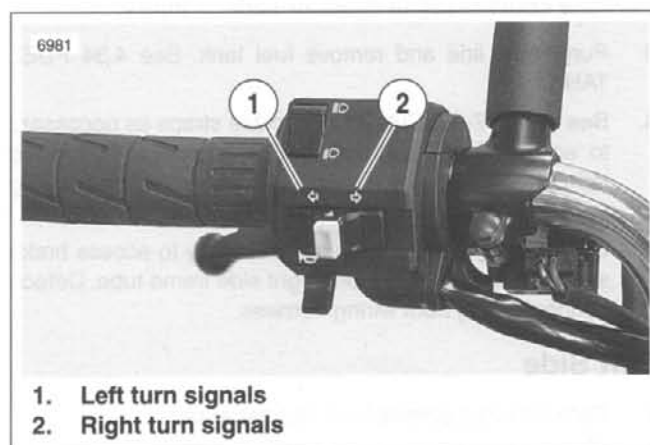


Figure 7-51. Turn Signal Controls

# HANDLEBAR SWITCHES

7.16

## REMOVAL

### NOTE

The individual handlebar switches are not repairable. Replace switch assembly upon switch failure.

### Right Side

1. Detach throttle cables. See 2.31 THROTTLE CONTROL.
2. Remove seat.

### WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (49 psi [338 kPa]). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before attaching fuel pressure gauge. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

3. Purge fuel line and remove fuel tank. See 4.34 FUEL TANK.
4. See Figure 7-52. Cut as many cable straps as necessary to access right handlebar switch connector [22] along right side frame tube. Detach connector [22] from wiring harness.
5. Cut as many cable straps as necessary to access brake switch connector [21] along right side frame tube. Detach connector [21] from wiring harness.

### Left Side

1. Remove three screws from handlebar switch.
2. Separate switch housings and remove from handlebar.
3. Remove seat.

### WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (49 psi [338 kPa]). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before attaching fuel pressure gauge. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

4. Purge fuel line and remove fuel tank. See 4.34 FUEL TANK.
5. See Figure 7-54. Cut as many cable straps as necessary to access left handlebar switch connector [24] along right side frame tube. Detach connector [24] from wiring harness.
6. Cut as many cable straps as necessary to access clutch switch connector [95] along right side frame tube. Detach connector [95] from wiring harness.

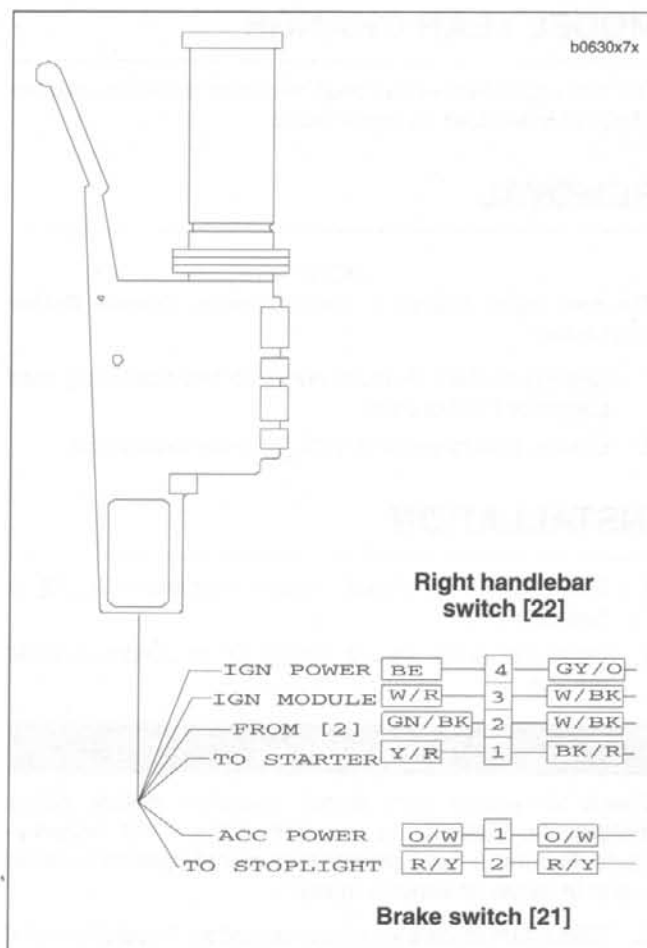


Figure 7-52. Right Handlebar Switch Connection

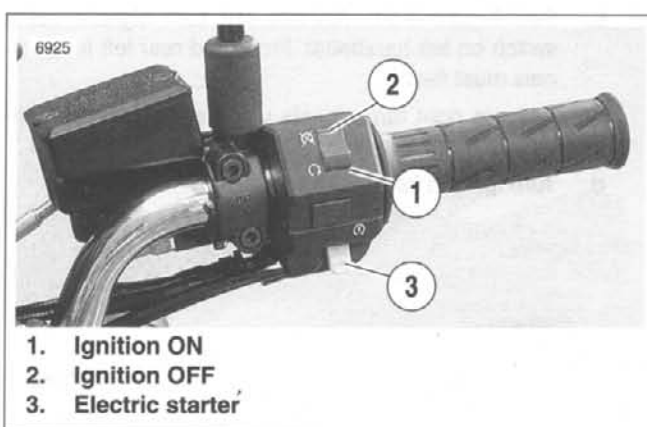


Figure 7-53. Right Handlebar Switches

## INSTALLATION

### Right Side

1. Attach throttle cables to hand control. See 2.31 THROTTLE CONTROL.
2. Position housings on right handlebar by engaging locating pin on front housing with hole in handlebar. Attach housings with two screws (1, 6), installing longer screw on bottom. Tighten to 12-17 **in-lbs** (1.4-1.9 Nm).
3. See Figure 7-56. Route switch housing wiring harness between front forks and along right side frame tube. Attach connector [22] and, if necessary, connector [21] to wiring harness. Fasten wiring harness to frame with **new** cable straps.
4. Install fuel tank. See 4.34 FUEL TANK.

#### **WARNING**

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

5. Install seat.
6. Adjust throttle cables. See 1.22 THROTTLE CABLES.

#### **WARNING**

Check all handlebar switch operations before riding motorcycle. Visibility is a major concern for motorcyclists. Handlebar switches not operating properly could result in death or serious injury.

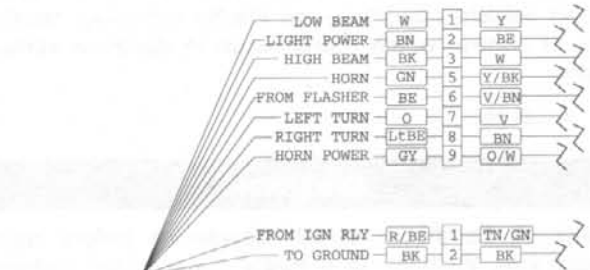
7. Check handlebar switch for proper operation. If operation fails, reread procedure and verify that all steps were performed.
  - a. Turn ignition key switch to IGN.
  - b. Start motorcycle.
  - c. Turn ignition key switch to OFF.

### Left Side

1. Attach switch housing to handlebar with three screws. Tighten to 25-33 **in-lbs** (2.8-3.7 Nm).
2. See Figure 7-57. Route switch housing wiring harness between front forks and along right side frame tube. Attach connector [24] and, if necessary, connector [95] to wiring harness. Fasten wiring harness to frame with **new** cable straps.
3. Install fuel tank. See 4.34 FUEL TANK

b0631x7x

#### Left handlebar switch [24]



#### Clutch switch [95]

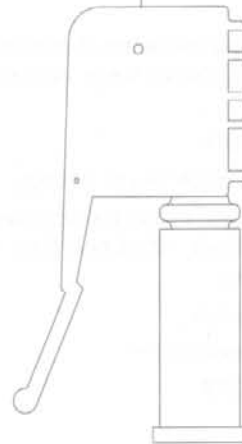
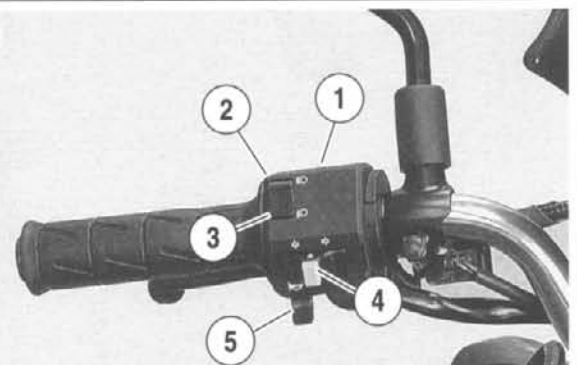


Figure 7-54. Left Handlebar Switch Connection

6926



1. Passing lamp
2. HIGH beam
3. LOW beam
4. Turn signals
5. Horn

Figure 7-55. Left Handlebar Switches



**⚠ WARNING**

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury.

4. Install seat.

**⚠ WARNING**

Check all handlebar switch operations before riding motorcycle. Visibility is a major concern for motorcyclists. Handlebar switches not operating properly could result in death or serious injury.

5. Check handlebar switch for proper operation. If operation fails, reread procedure and verify that all steps were performed.
  - a. Turn ignition key switch to IGN.
  - b. Check headlamp LOW and HIGH beam settings.
  - c. Set headlamp to LOW beam. Press passing lamp switch. Headlamp should flash HIGH beam for as long as the switch is pressed.
  - d. Check left and right turn signals.
  - e. Activate horn by pressing horn switch.
  - f. Turn ignition key switch to OFF.

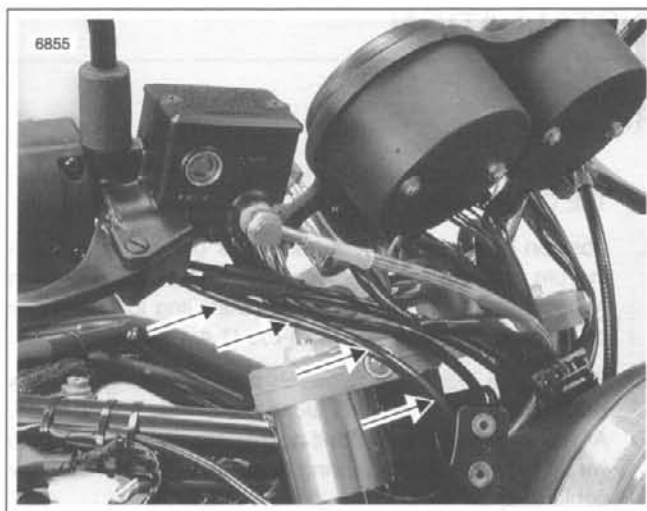


Figure 7-56. Routing Handlebar Wires, Right



Figure 7-57. Routing Handlebar Wires, Left

# SPEEDOMETER SENSOR

7.17

## REMOVAL

1. See Figure 7-58. Remove bolt (1) to detach speedometer sensor (2) from crankcase.
2. See Figure 7-59. Disconnect 3-place Deutsch connector [65] under battery tray.

## INSTALLATION

1. See Figure 7-58. Install bolt (1) to attach speedometer sensor (2) to crankcase.
2. Connect speedometer sensor connector [65] to wiring harness.

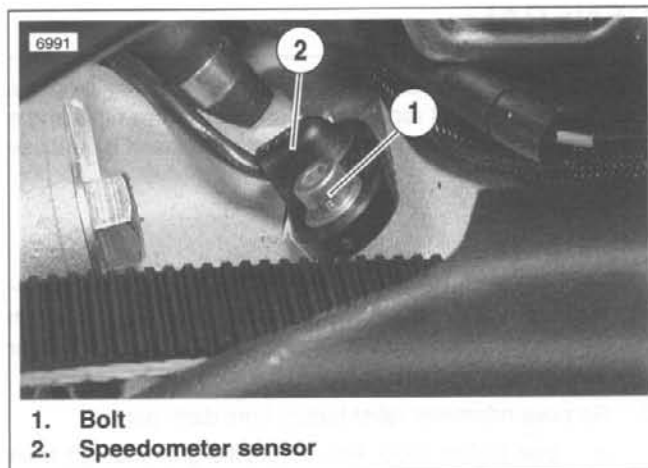


Figure 7-58. Speedometer Sensor

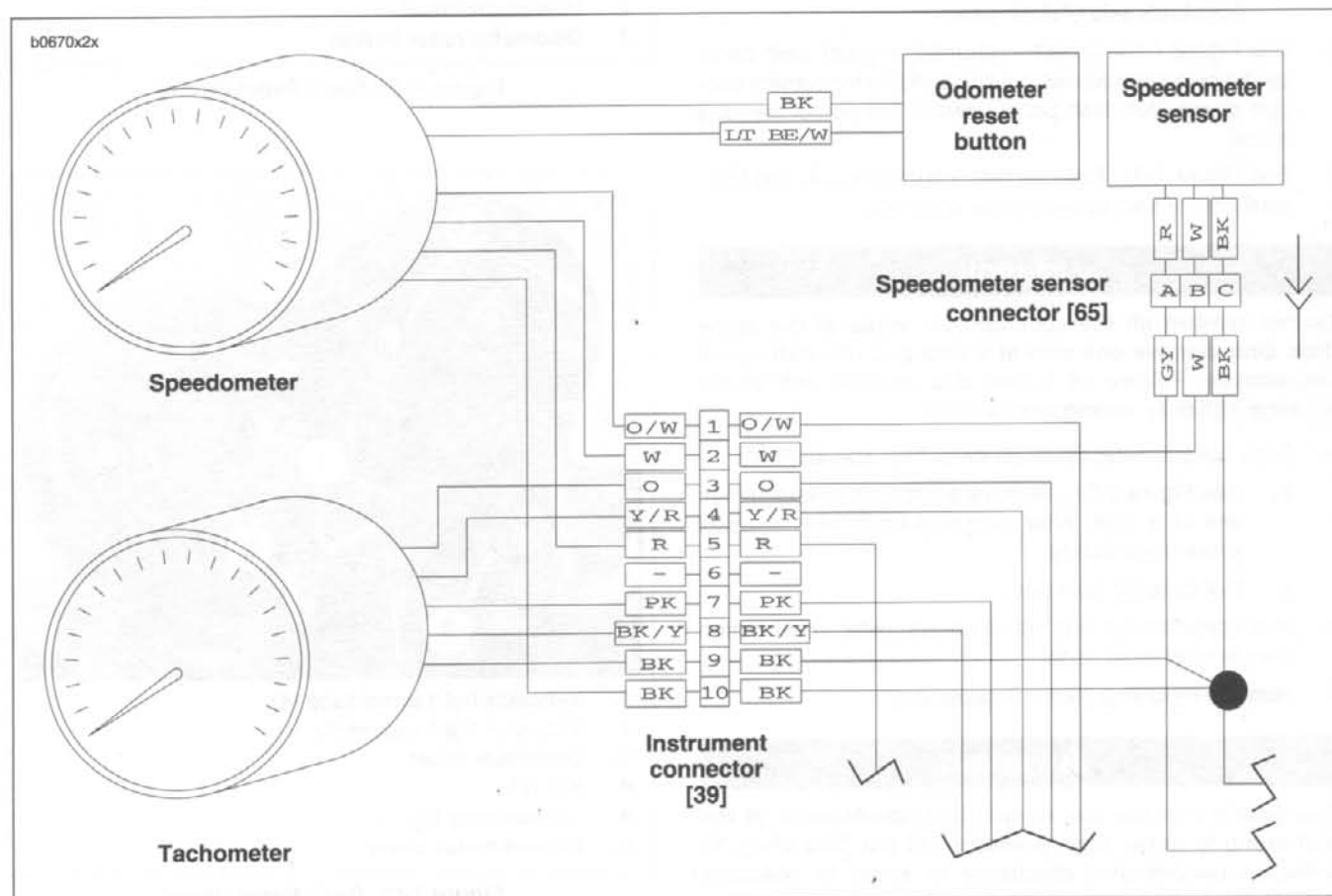


Figure 7-59. Speedometer Sensor Wiring



# SPEEDOMETER

7.18

## GENERAL

Replace the speedometer if the unit is not working properly. The instrument is not repairable. However, before replacing a component, check that the problem is not caused by a loose wire connection.

## REMOVAL

1. Gain access to the back side of the dash panel. Detach windscreen from mounting brackets by removing four screws and washers.
2. Remove odometer reset button from dash panel.
  - a. See Figure 7-60. Pry off plastic grommet (2) from front of odometer reset button (3).
  - b. See Figure 7-61. Remove odometer reset button (3) from back side of dash panel.
3. See Figure 7-60. Detach instrument support dash panel by removing two screws holding panel to instrument support clamp. Pull dash panel upward, but do not damage wiring.
4. See Figure 7-61. Remove two nuts (metric) (4) and lockwashers (5) from speedometer cover (6).

### CAUTION

Do not remove all the speedometer wires at the same time. Only remove one wire at a time and reinstall screw immediately. Failure to follow this caution will cause extreme difficulty during reassembly.

5. Slide speedometer cover (6) away from speedometer.
  - a. See Figure 2-62. Remove wires from speedometer, one at a time. After removing each wire, reinstall screw immediately.
  - b. Pull lamp (5) from bore.
6. Pull speedometer and attached odometer reset button from front of dash panel.
7. Remove mounting gasket if necessary.

### WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (49 psi [338 kPa]). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before attaching fuel pressure gauge. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

8. If necessary, replace speedometer wiring.
  - a. Purge fuel line and remove fuel tank. See 4.34 FUEL TANK.
  - b. Cut cable straps on wiring harness. Detach wires at plug connector.

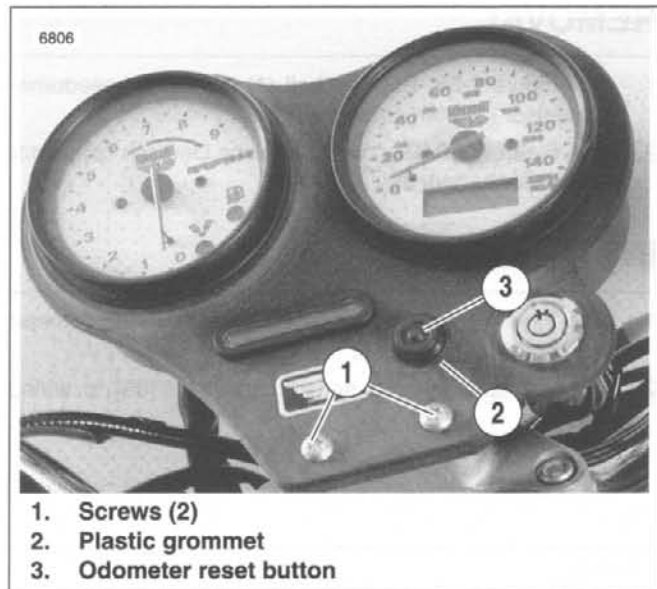


Figure 7-60. Dash Panel (Front)

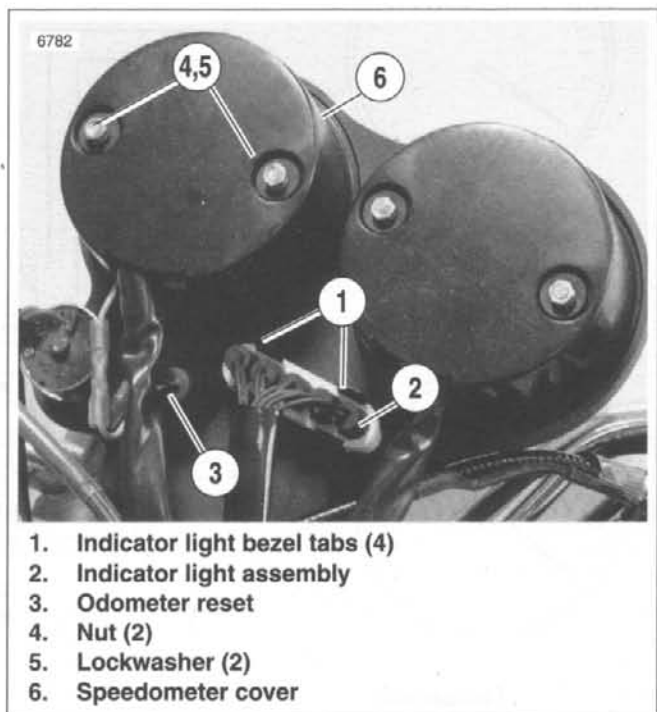


Figure 7-61. Dash Panel (Back)

### NOTE

Tachometer and speedometer wiring share a common connector [39] on the wiring harness.

## INSTALLATION

1. If replacing speedometer wiring:
  - a. See Figure 2-63. Attach wires at plug connector.
  - b. Feed wiring through to dash panel and secure with ties on electrical cabling.
  - c. Install fuel tank. See 4.34 FUEL TANK.
2. Install odometer reset.
  - d. See Figure 7-61. Install odometer reset button (3) from back side of dash panel.
  - e. See Figure 7-60. Secure odometer reset button (3) on front of dash panel with plastic grommet (2).
3. Install rubber mounting gasket if removed.
  - a. Apply 2 drops of adhesive (Permabond 105) at each end of notches in gasket.
  - b. Apply 1 drop of adhesive (Permabond 105) at top of gasket and bottom of gasket.
  - c. Position mounting gasket in dash panel.
4. Install speedometer in dash panel.
  - a. Feed wires through opening in speedometer cover.
  - b. Slide speedometer into rubber mounting gasket.
  - c. See Figure 2-62. Insert lamp (5).
  - d. Attach wires to speedometer as shown.
5. See Figure 7-61. Install speedometer cover (6).
  - a. Place speedometer cover over speedometer. Align posts on back of speedometer with holes in cover. Drain hole must be at the bottom of cover.
  - b. Apply LOCTITE THREADLOCKER 243 (blue) to both nuts (metric) (4).
  - c. Fasten cover (6) to speedometer using two nuts (metric) (4) and lockwashers (5).
6. See Figure 7-60. Position dash panel on instrument support clamp.
  - a. Attach dash panel using two screws (1) to hold panel to clamp.
  - b. Tighten screws to 4-5 ft-lbs (5.4-6.8 Nm).
  - c. Attach windscreen to mounting brackets using four screws and washers.

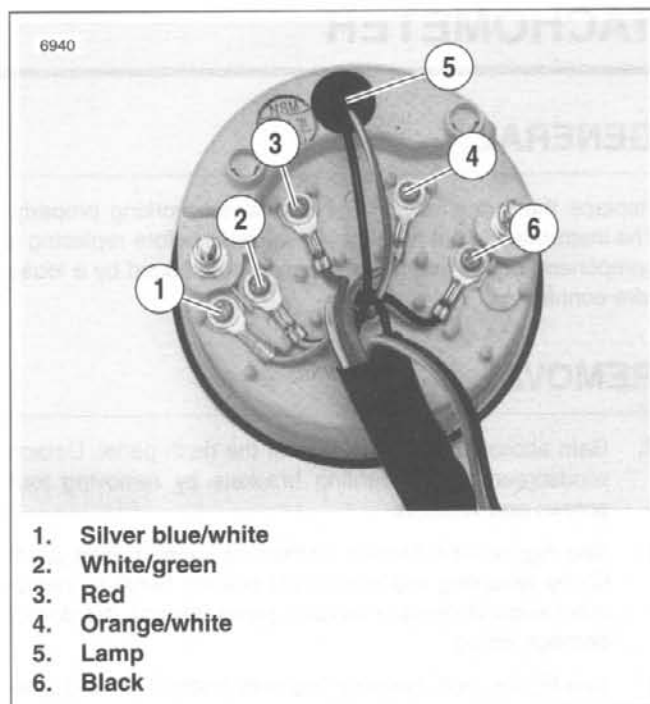


Figure 2-62. Speedometer Wiring

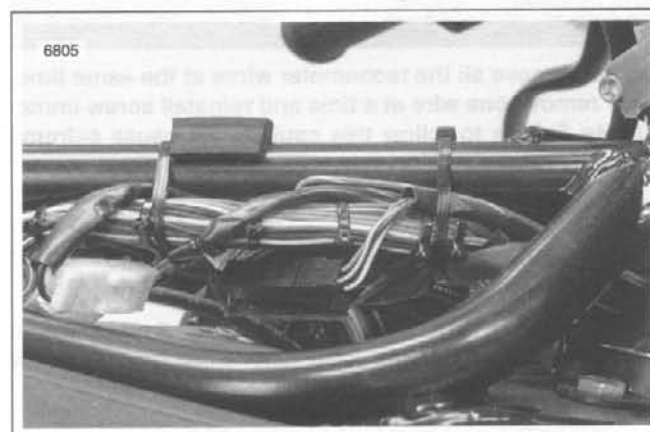


Figure 2-63. Speedometer Wiring Connector Locations (Approximate)

## GENERAL

Replace the tachometer if the unit is not working properly. The instrument is not repairable. However, before replacing a component, check that the problem is not caused by a loose wire connection.

## REMOVAL

1. Gain access to the back side of the dash panel. Detach windscreen from mounting brackets by removing four screws and washers.
2. See Figure 7-64. Detach instrument support dash panel (2) by removing two screws (1) holding panel to instrument support clamp. Pull dash panel upward, but do not damage wiring.
3. See Figure 7-65. Remove two nuts (metric) (3) and lock-washers (4) from tachometer cover (5).
4. Slide tachometer cover (5) away from tachometer.

### CAUTION

**Do not remove all the tachometer wires at the same time. Only remove one wire at a time and reinstall screw immediately. Failure to follow this caution will cause extreme difficulty during reassembly.**

5. See Figure 7-66. Remove wires from tachometer.
  - a. Remove three lamps (1, 2, and 3) and attached wires.
  - b. Loosen screws and remove wires (4, 5 and 6) one at a time. After removing each wire, reinstall screw immediately.
6. Pull tachometer from front of dash panel.
7. Remove rubber mounting gasket if necessary.

### WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (49 psi [338 kPa]). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before attaching fuel pressure gauge. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

8. If necessary, replace tachometer wiring.
  - a. Purge fuel line and remove fuel tank. See 4.34 FUEL TANK.
  - b. Cut cable straps on wiring harness. See Figure 7-67. Detach wires at plug connector.

### NOTE

*Tachometer and speedometer wiring share a common connector [39] on the wiring harness.*

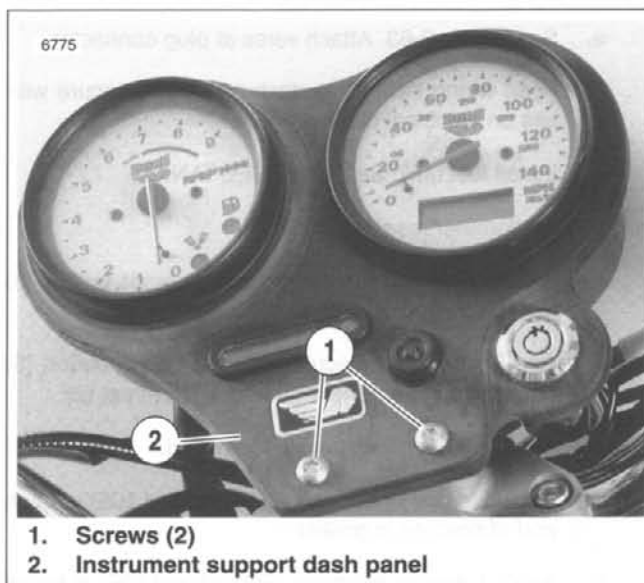


Figure 7-64. Front Dash Panel

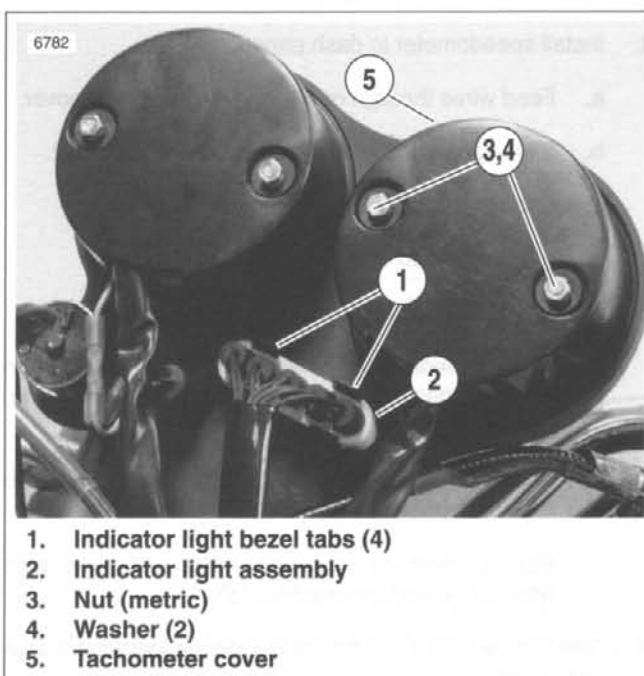


Figure 7-65. Back Dash Panel

## INSTALLATION

1. If replacing tachometer wiring:
  - a. See Figure 7-67. Attach wires at plug connector.
  - b. Feed wiring through wiring harness to dash panel and secure with ties on electrical cabling.
  - c. Install fuel tank. See 4.34 FUEL TANK.
2. Install rubber mounting gasket if removed.
  - a. Apply 2 drops of adhesive (Permabond 105) at each end of notches in gasket.
  - b. Apply 1 drop of adhesive (Permabond 105) at top of gasket and bottom of gasket.
  - c. Position mounting gasket in dash panel.
3. Install tachometer in dash panel.
  - a. Feed wires through opening in tachometer cover.
  - b. Slide tachometer into rubber mounting gasket.
  - c. See Figure 7-66. Insert lamps (1, 2 and 3) into their appropriate bores.
  - d. Attach wires (4, 5 and 6) to tachometer as shown.
4. See Figure 7-66. Install tachometer cover (5).
  - a. Place tachometer cover over tachometer. Align posts on back of tachometer with holes in tachometer cover. Drain hole must be at the bottom of cover.
  - b. Apply LOCTITE THREADLOCKER 243 (blue) to both nuts (metric) (3).
  - c. Fasten cover (5) to tachometer using two nuts (metric) (3) and lockwashers (4).
5. See Figure 7-64. Position dash panel on instrument support clamp.
  - a. Attach dash panel using two screws (1) to hold panel to clamp.
  - b. Tighten screws to 4-5 ft-lbs (5.4-6.8 Nm).
  - c. Attach windscreen to mounting brackets using four screws and washers.

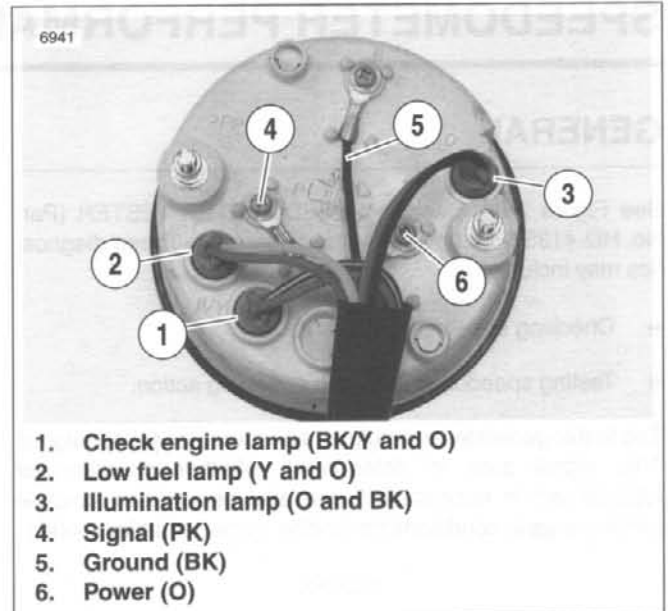


Figure 7-66. Tachometer Wiring

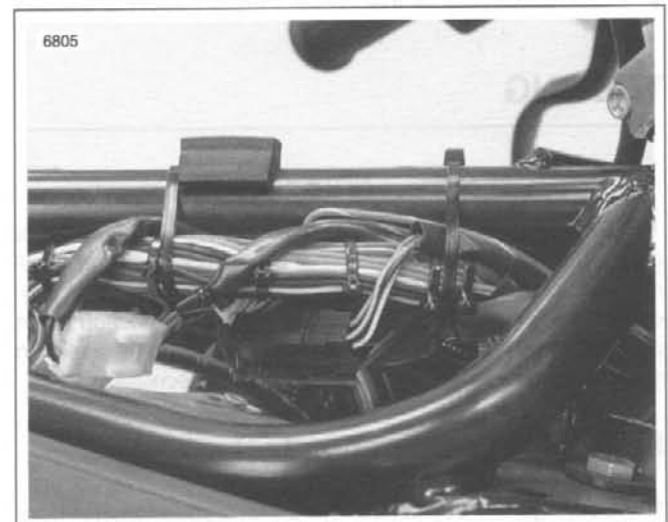


Figure 7-67. Tachometer Wiring Connector Locations (Approximate)

## GENERAL

See Figure 7-68. Use the SPEEDOMETER TESTER (Part No. HD-41354) for speedometer diagnostics. These diagnostics may include:

- Checking speedometer operation.
- Testing speedometer needle sweeping action.

The tester generates a simulated speedometer sensor signal. This signal aids in determining whether speedometer replacement is necessary. It can also be used to simulate running engine conditions for ignition system troubleshooting.

### NOTES

- Use the following procedures in conjunction with the manual supplied with the speedometer tester.
- Test results may be inaccurate if tester battery is low.

## TESTING

### NOTE

The SPEEDOMETER TESTER (Part No. HD-41354) cannot be used to verify the calibration of a speedometer and it will not verify the speedometer's function to support legal proceedings. It's purpose is to verify speedometer function when performing service diagnosis or repair. It can also assist in determining if speedometer replacement is necessary.

### Speedometer Operation Test

1. See Figure 7-69. Locate the 3-place speedometer connector [65] under the battery tray and disconnect. Attach speedometer tester connector.
2. Place speedometer tester power switch in the ON position. Place signal switch in the OUT position.
3. Turn vehicle ignition switch ON.
4. Begin test.
  - a. Press ENTER on the tester keypad.
  - b. Enter a frequency from Table 7-2. Note that different markets use different frequencies.
  - c. Verify that speedometer display reads the corresponding speed. To change the test frequency, press CLEAR to cancel and enter the new frequency. Press ENTER to begin and reverify.

### NOTE

The speedometer should be accurate within 0-4 MPH (0-6.5 KPH).

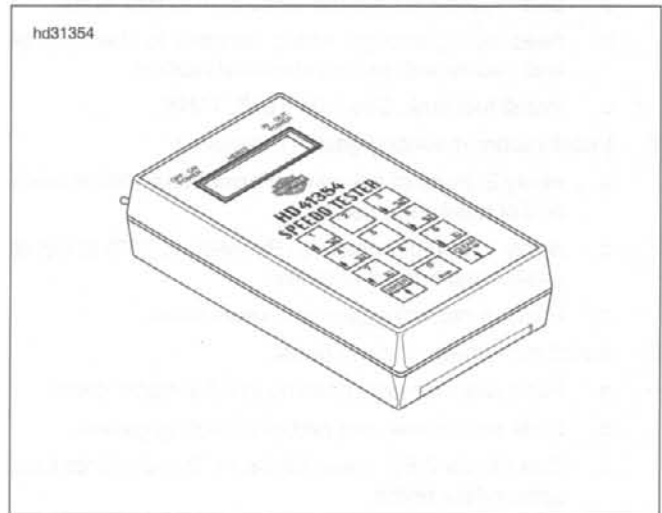


Figure 7-68. Speedometer Tester



Figure 7-69. Speedometer Sensor Connector (Battery Removed For Illustration Purposes Only)

Table 7-2. Speedometer Test Frequency in Hertz (Hz)

MARKET	20 MPH (30 KPH)	40 MPH (60 KPH)	60 MPH (100 KPH)	80 MPH (130 KPH)
USA	432	864	1296	1728
ENG	362	725	1088	1454
AUS, EUR	340	680	1134	1474
CAN, JPN, NZ	405	810	1350	1755



## Speedometer Needle Sweep Test

The tester's sweep function moves the speedometer needle through the full range of movement. This allows for testing the smoothness of operation and checking for hesitancy or a stuck needle.

1. See Figure 7-69. Disconnect speedometer sensor connector. Attach speedometer tester connector to speedometer sensor connector.
2. Place speedometer tester power switch in the ON position. Place signal switch in the OUT position.
3. Turn vehicle ignition switch ON.
4. Begin test by pressing 0 on the tester keypad, then pressing ENTER. The tester will scan for two seconds, then the tester will put out a 1 Hz signal.
5. Select a test range.
  - a. Press 2 to select LO range (1-20 Hz).
  - b. Press 5 to select CEN range (21-999 Hz).
  - c. Press 8 to select HI range (1000-20,000 Hz).
6. After selecting a range, use the corresponding arrow keys to accelerate through the range. As you move through the speed range, check for smooth needle movement.
  - a. If testing LO range, press 1 or 3.
  - b. If testing CEN range, press 4 or 6.
  - c. If testing HI range, press 7 or 9.

## Speedometer Sensor Test

If the speedometer is inoperative, but backlighting and odometer work, the speedometer sensor may not be working.

See Figure 7-70. Fabricate a test harness using the following parts. This harness can also be used to test the tachometer.

- Two Deutsch 3-place socket housings (Part No. 72113-94BK) and six socket terminals (Part No. 72191-94).
- Deutsch 3-place pin housing (Part No. 72103-94BK) and three pin terminals (Part No. 72080-99Y).
- Six lengths of 18 gauge wire, each 6.0 in. (15 cm) long.

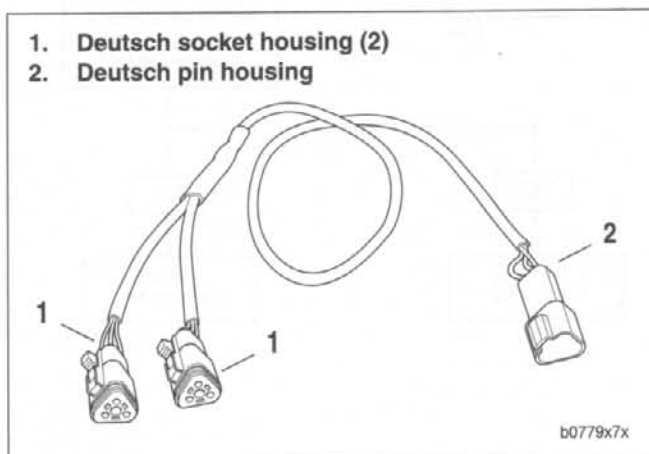


Figure 7-70. Test Harness

Before attempting the actual speedometer sensor check, two system checks must be made. Install the test harness at the cam position sensor connector [14]. See Figure 7-71.

- Test for voltage to sensor by checking for 8-12 VDC on red wire in connector [65].
  - Then check for continuity to ground on black wire in connector [65].
1. Raise rear wheel off floor using REAR WHEEL SUPPORT STAND (Part No. B-41174).
  2. Install the test harness between the speedometer sensor connectors.
  3. Place speedometer tester power switch in the ON position. Place signal switch in the IN position.
  4. Plug the speedometer tester into the test harness. Turn vehicle ignition switch ON.
  5. Press ENTER on the tester keypad.
  6. Rotate the motorcycle's rear wheel.
    - a. If reading on speedometer tester changes as wheel is rotated, speedometer sensor is OK.
    - b. If reading does not change, speedometer sensor is suspect. Install a known, good speedometer sensor and test again.

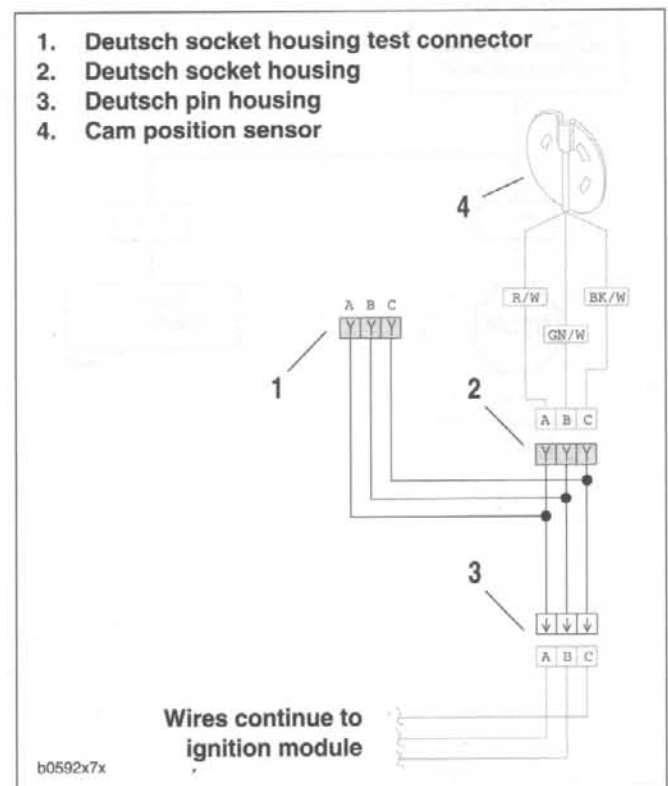
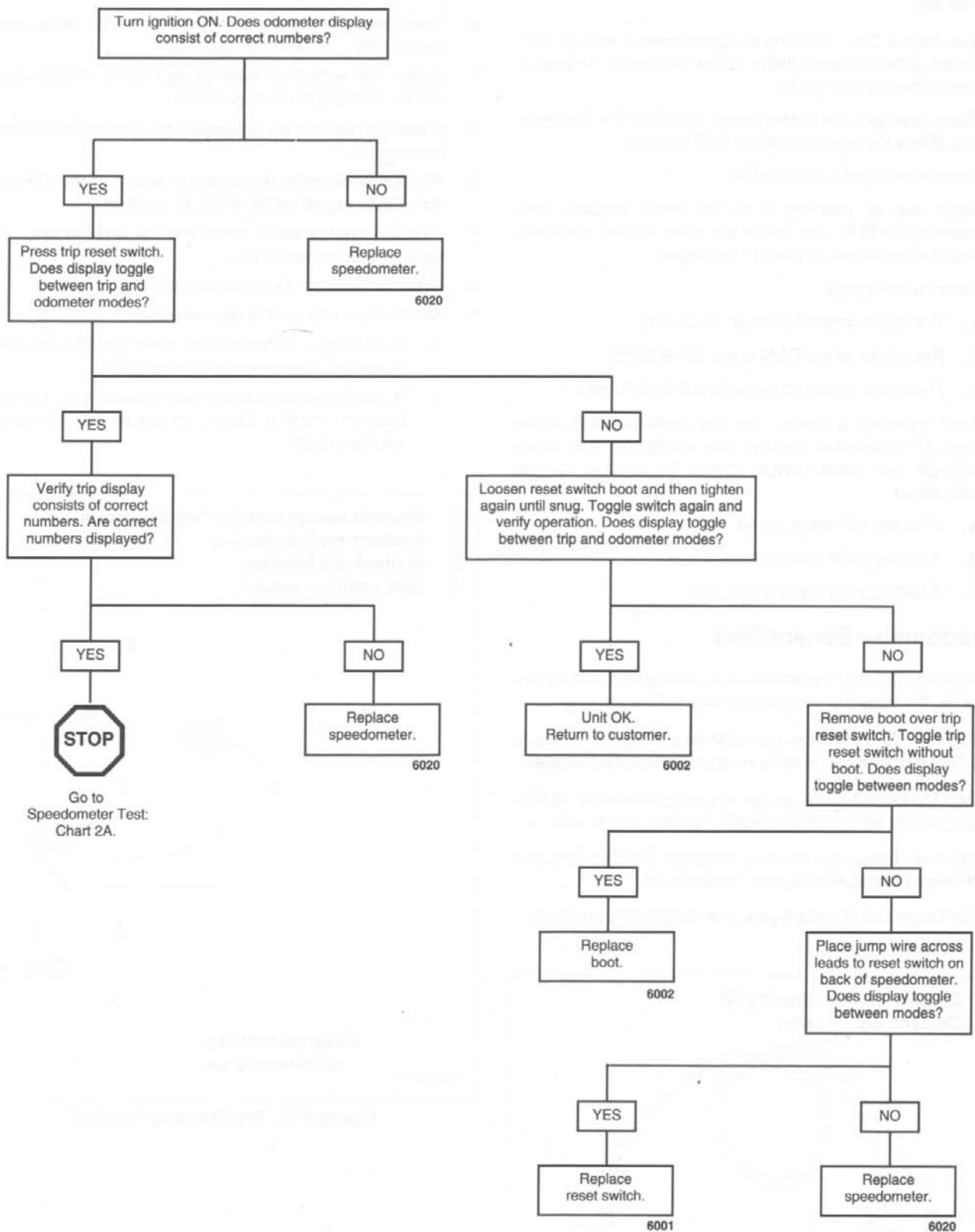


Figure 7-71. Test Harness Installed

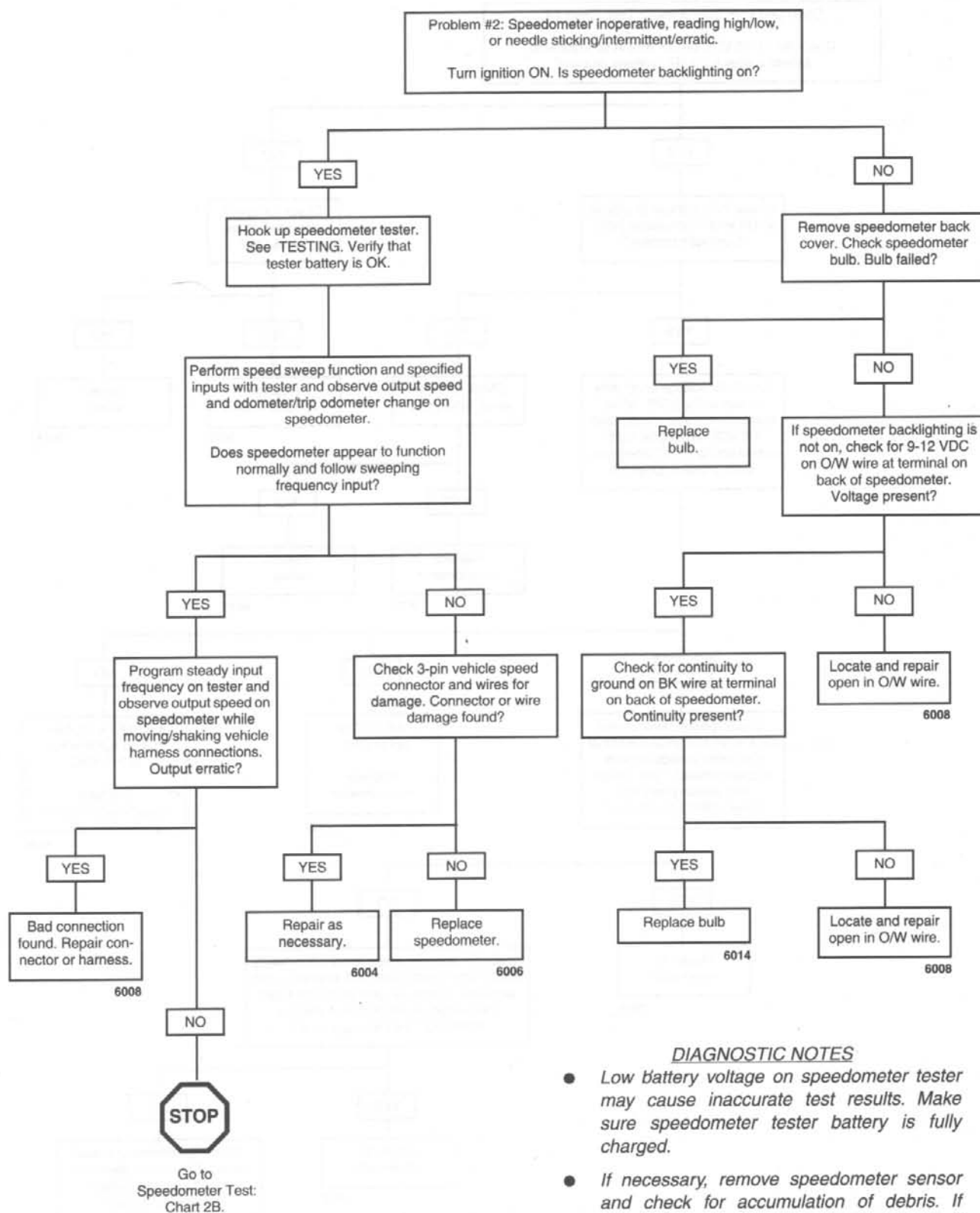
## Speedometer Test: Chart 1

### ODOMETER, TRIP ODOMETER AND RESET SWITCH TESTING



## Speedometer Test: Chart 2A

### INOPERATIVE, INACCURATE OR ERRATIC SPEEDOMETER



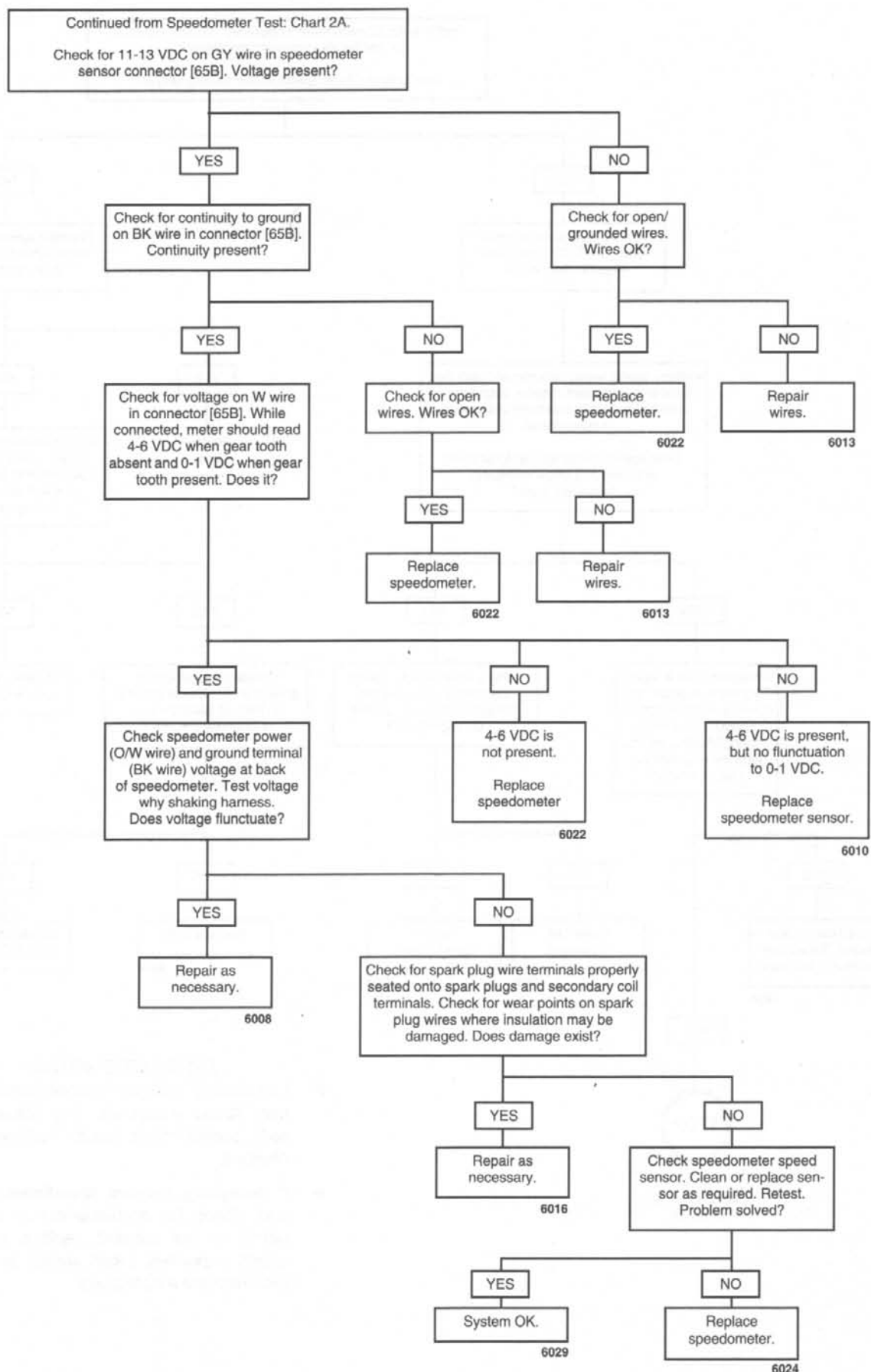
#### DIAGNOSTIC NOTES

- Low battery voltage on speedometer tester may cause inaccurate test results. Make sure speedometer tester battery is fully charged.
- If necessary, remove speedometer sensor and check for accumulation of debris. If debris is not present, replace sensor. If debris is present, clean sensor and repeat test. Replace if necessary.



## Speedometer Test: Chart 2B

### INOPERATIVE, INACCURATE OR ERRATIC SPEEDOMETER



# TACHOMETER PERFORMANCE CHECK

7.21

## GENERAL

See Figure 7-68. Use the SPEEDOMETER TESTER (Part No. HD-41354) for tachometer diagnostics. These diagnostics may include:

- Checking tachometer operation.
- Testing tachometer needle sweeping action.

The tester can be connected to the vehicle's cam position sensor connector. This connection introduces a signal to the ignition module that simulates the signal from the cam position sensor. The ignition module will use this simulated signal to open and close circuits to fire the spark plugs. This allows you to simulate the engine running and therefore generate tachometer readings.

## TESTING

### Operation Test

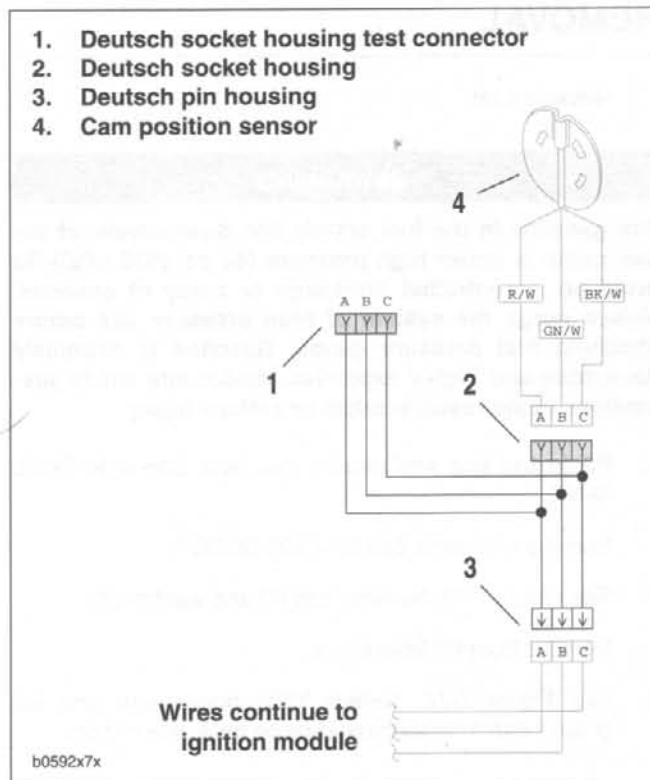
1. See Figure 7-72. Connect the speedometer tester to the cam position sensor Deutsch socket housing.
2. Convert the desired test RPM to a tester frequency in Hertz. Several conversions are listed in Table 7-2.
  - a. Select a desired tachometer reading for testing. This example will use 2000 RPM.
  - b. Divide the desired tachometer reading by 60. For example,  $2000/60=33.3$ .
3. Enter the result (33.3 for 2000 RPM) into the speedometer tester.
  - a. The tachometer should respond by moving its needle to the desired RPM.
  - b. Test the tachometer at several different RPM readings to verify proper operation.

**Table 7-3. Tachometer Accuracy Tolerances and Conversions**

READING	2000 RPM	4000 RPM	6000 RPM	7500 RPM
Tolerance (+/- RPM)	100	120	210	320
Conversion factor	33.3	66.7	100	125

### NOTE

All tachometer accuracy tolerances were taken at 68°-77° F (20-25° C).



**Figure 7-72. Testing Tachometer**

### Sweep Test

1. See Figure 7-72. Connect the speedometer tester to the cam position sensor Deutsch socket housing.
2. Place speedometer tester power switch in the ON position. Place signal switch in the OUT position.
3. Turn vehicle ignition switch ON.
4. Begin test by pressing 0 on the tester keypad, then pressing ENTER. The tester will scan for two seconds, then the tester will put out a 1 Hz signal.
5. Select a test range.
  - a. Press 2 to select LO range.
  - b. Press 5 to select CEN range.
  - c. Press 8 to select HI range.
6. After selecting a range, use the corresponding arrow keys to accelerate through the range. As you move through the speed range, check for smooth needle movement.
  - a. If testing LO range, press 1 or 3.
  - b. If testing CEN range, press 4 or 6.
  - c. If testing HI range, press 7 or 9.

## REMOVAL

1. Remove seat.

### WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (49 psi [338 kPa]). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before attaching fuel pressure gauge. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

2. Purge fuel line and remove fuel tank. See 4.34 FUEL TANK.
3. Remove air scoop. See 2.44 AIR SCOOP.
4. See Figure 7-73. Remove bolt (1) and washer (2).
5. Remove horn (3) from frame.
6. See Figure 7-74. Detach Y/BK power wire and BK ground wire from terminal clips on back side of horn.

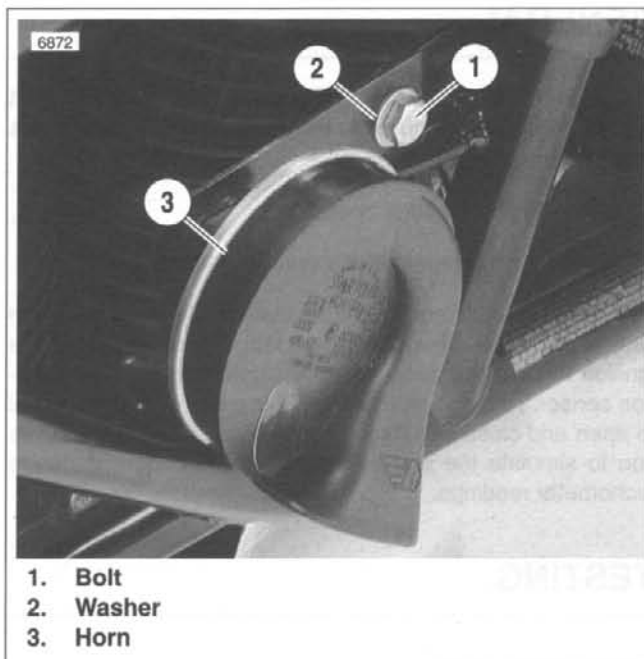


Figure 7-73. Horn Assembly

## INSTALLATION

1. See Figure 7-74. Connect Y/BK power wire and BK ground wire to terminal clips on back side of horn.
2. See Figure 7-73. Attach horn (3) to frame using bolt (1) and washer (2).
3. Check horn operation. If horn does not sound or fails to function satisfactorily, see TROUBLESHOOTING.
  - a. Turn ignition key switch to IGN.
  - b. Press horn switch to activate horn.
  - c. Turn ignition key switch to OFF.
4. Install air scoop. See 2.44 AIR SCOOP.
5. Install fuel tank. See 4.34 FUEL TANK.

### WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control. These events could result in death or serious injury.

6. Install seat.

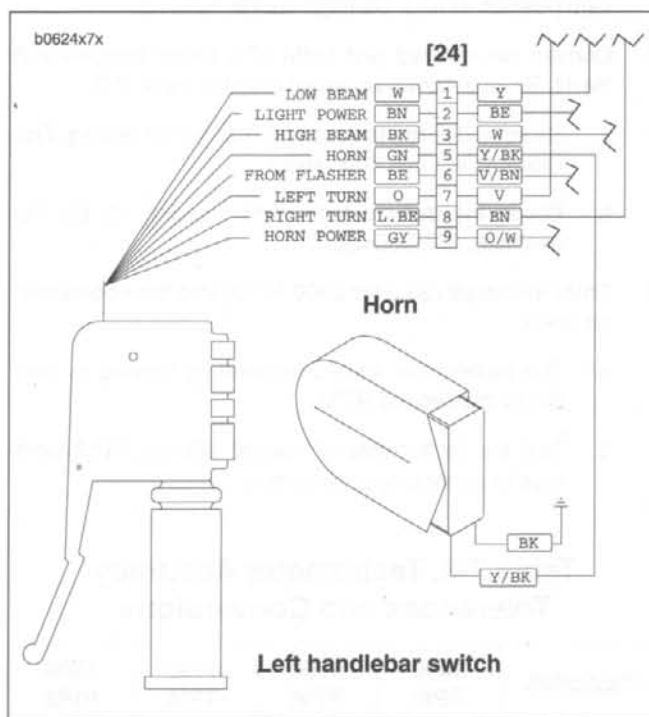


Figure 7-74. Horn Wiring

## TROUBLESHOOTING

1. If the horn does not sound or fails to function satisfactorily, check for the following conditions:
  - a. Discharged battery.
  - b. Loose, frayed or damaged wiring leading to horn terminal.
2. If battery has a satisfactory charge and wiring appears to be in good condition, test horn grounds and switch using voltmeter.
  - a. See Figure 7-74. Remove Y/BK power and BK ground wires from terminal clips.
  - b. Connect voltmeter positive (+) lead to Y/BK wire.
  - c. Connect voltmeter negative (-) lead to ground.
  - d. Turn ignition key switch to IGN.
3. See Figure 7-75. Depress horn switch and observe voltmeter reading.
  - a. If battery voltage is present, horn or horn grounding is faulty. If horn is faulty, replace unit as an assembly. The horn is not repairable.
  - b. If battery voltage is not present, either horn switch or wiring to horn is faulty. If horn switch is faulty, replace left handlebar switch. See 7.16 HANDLEBAR SWITCHES.

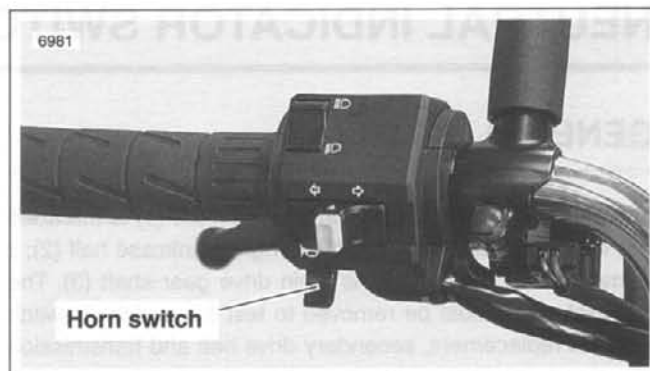


Figure 7-75. Horn Switch

## GENERAL

See Figure 7-76. The neutral indicator switch (1) is threaded into the transmission portion of the right crankcase half (2); it is immediately forward of the main drive gear shaft (3). The sprocket cover must be removed to test the switch. If switch requires replacement, secondary drive belt and transmission sprocket must also be removed; there is not enough clearance to allow the removal of the switch without first removing the transmission sprocket.

A pin on the shifter drum contacts the neutral indicator switch plunger, completing the neutral indicator circuit. The switch is not repairable. Replace the switch if it malfunctions.

## TESTING

1. Remove sprocket cover. See 2.38 SPROCKET COVER.
2. See Figure 7-76. Disconnect wire lead from neutral indicator switch (1).
3. Turn ignition key switch to IGN. Touch the neutral indicator wire lead to a suitable ground.
  - a. If indicator lamp lights, then problem is at indicator switch. Replace switch.
  - b. If indicator lamp does not light, then problem is elsewhere in circuit. Check for loose connections, burned out indicator lamps or faulty wiring.
  - c. After testing and repair, connect wire lead to indicator switch.
4. Install sprocket cover. See 2.38 SPROCKET COVER.

## REMOVAL/INSTALLATION

1. Verify that the ignition key switch is turned to OFF.
2. Remove sprocket cover. See 2.38 SPROCKET COVER.
3. See Figure 7-76. Place transmission in first gear. Remove two socket head screws (7) and lockplate (6).

### CAUTION

**Transmission sprocket nut has left-hand threads. Turn nut clockwise to loosen and remove from main drive gear shaft. Transmission sprocket nut will be damaged if turned counterclockwise to remove.**

4. Remove transmission sprocket nut (5) from main drive gear shaft (3). See 6.7 TRANSMISSION CASE.

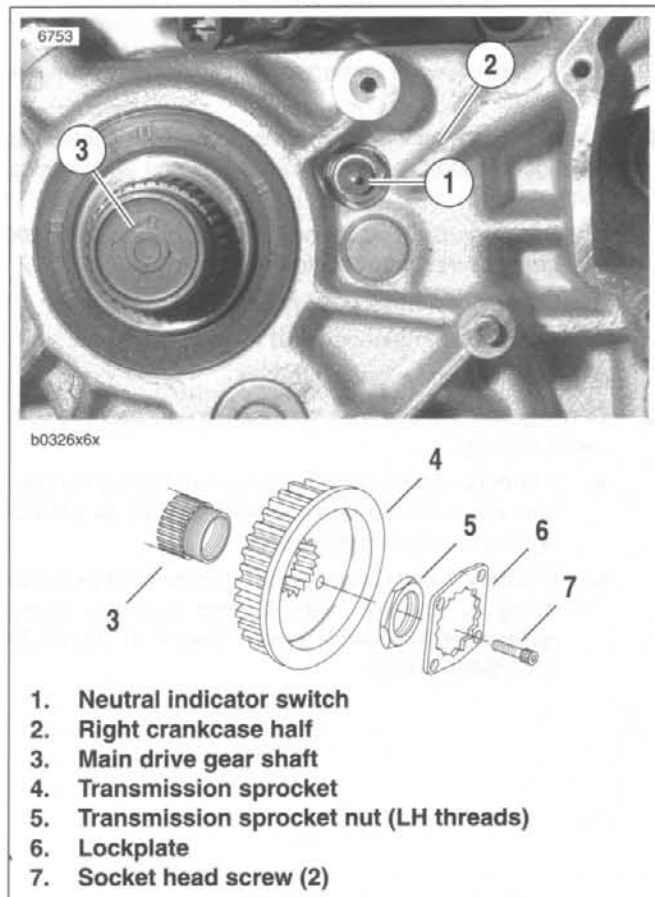


Figure 7-76. Neutral Indicator Switch

5. Decrease secondary drive belt tension by loosening axle adjusting nuts. See 1.13 REAR BELT DEFLECTION. Remove transmission sprocket (4) (with secondary drive belt) from main drive gear shaft (3).
6. Remove wire lead from neutral indicator switch (1). Remove switch from right crankcase half (2).
7. Install **new** neutral indicator switch.
  - a. Apply a light coating of LOCTITE THREADLOCKER 243 (blue) to **new** neutral indicator switch (1) threads.
  - b. Install switch in crankcase. Tighten to 3-5 ft-lbs (4.0-6.8 Nm).
  - c. Connect wire lead to switch.
8. Install transmission sprocket (4) (with secondary drive belt) onto main drive gear shaft (3). See 6.13 TRANSMISSION INSTALLATION AND SHIFTER PAWL ADJUSTMENT.
9. Install sprocket cover. See 2.38 SPROCKET COVER.
10. Adjust secondary drive belt tension. See 1.13 REAR BELT DEFLECTION.

## GENERAL

Buell motorcycles feature two components which protect the electrical system.

### Fuse

The fuse block is in the trunk, under the seat.

See Figure 7-77. The ignition (4) fuse is rated at 20 amps. Fuses for the odometer (5), lights (7), and instruments (8) and accessories (9) are each rated at 15 amps.

Always investigate the cause of blown fuses before replacing them. See your Buell dealer for more information.

### Master Circuit Breaker

See Figure 7-78. The 30 amp main circuit breaker is on the frame beneath the fuel tank.

#### WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before servicing motorcycle. Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

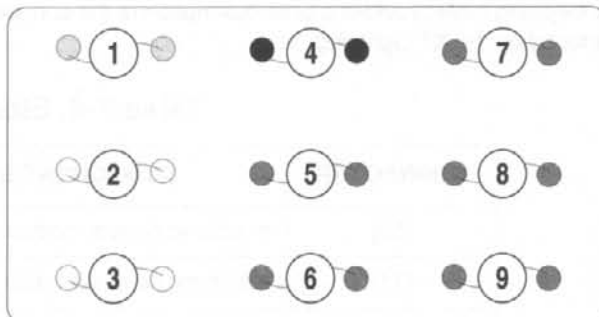
1. Disconnect battery cables, negative cable first.

#### WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (49 psi [338 kPa]). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before removing fuel tank. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

2. Purge fuel line and remove fuel tank. See 4.34 FUEL TANK.
3. Remove battery negative cable from frame.
4. See Figure 7-78. Loosen nut (2) on frame to free circuit breaker (3) from clip (1).
5. Remove nuts (5), star washers (4) and wire leads (6, 7 and 8) from circuit breaker studs.
6. Install in the reverse order.
  - a. BK wire connects to gold post.
  - b. All red wires connect to silver post.

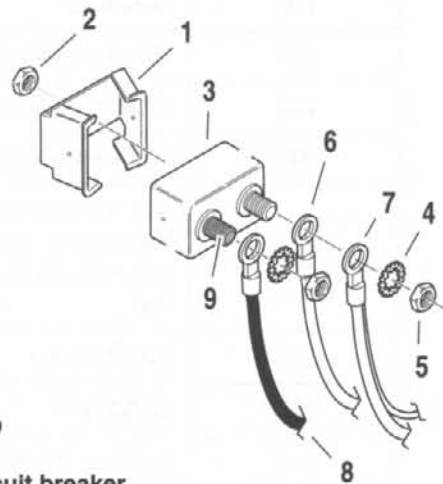
b0769x7x



1. Factory installed spare (15 or 20 amp)
2. Empty
3. Empty
4. Ignition (20 amp)
5. Odometer (15 amp)
6. Factory installed spare (15 amp)
7. Lights (15 amp)
8. Instruments (15 amp)
9. Accessory (15 amp)

Figure 7-77. Fuse Block

b0772x7x



1. Clip
2. Nut
3. Circuit breaker
4. Star washer (2)
5. Nut (2)
6. R wire from voltage regulator
7. R wires from key switch/fuse block
8. BK wire from starter
9. Circuit breaker gold post

Figure 7-78. Circuit Breaker

# ELECTRICAL CONNECTORS

7.25

## GENERAL

Connector numbers are listed in [brackets] in this manual.

The following table provides a brief description of the connectors found on the X1 Lightning.

**Table 7-4. Electrical Connectors**

CONNECTOR	COMPONENT(S)	DESCRIPTION
[10]	electronic control module (Black)	12-place Deutsch
[11]	electronic control module (Gray)	12-place Deutsch
[14]	cam position sensor	3-place Deutsch
[21]	front brake switch	2-place Amp Multilock
[21]	indicator lamps	12-place Amp Multilock
[22]	right handlebar switch housing- ignition power, module and starter	4-place connector
[24]	left handlebar switch housing- horn, turn signals, lights	9-place connector
[30]	flasher relay	3-place relay connector
[33]	ignition/headlamp switch	4-place Packard
[38]	headlamp	4-place Amp Multilock
[39]	speedometer and tachometer	10-place connector
[46]	voltage regulator/stator	2-place plug
[60]	side stand switch	2-place Amp Multilock
[61]	four 15 amp fuses for odometer, instruments, lights and accessories and one 20 amp fuse for ignition	5-slot fuse block
[65]	speed sensor	3-place Deutsch
[83]	ignition coil	3-place Packard
[84]	front fuel injector	2-place connector
[85]	rear fuel injector	2-place connector
[86]	fuel pump	4-place connector
[88]	throttle position sensor	3-place connector
[89]	intake air temperature sensor	2-place connector
[91]	data link	4-place Deutsch
[95]	clutch switch	2-place Amp Multilock
[96]	clock	4-place plug
[134]	bank angle sensor	3-place connector



## GENERAL

The Deutsch Connector features a superior seal to protect electrical contacts from dirt and moisture in harsh environments. The connector also provides better pin retention than previous connectors.

Three and eight pin connectors are of similar construction with one exception: eight pin connectors use two external latches on the socket side.

### NOTE

Use the **DEUTSCH TERMINAL CRIMP TOOL** (Part No. HD-39965) to install Deutsch pin and socket terminals on wires. If **new** terminals must be installed, follow the instructions included with the crimping tool or see **CRIMPING INSTRUCTIONS**.

## REMOVING/INSTALLING SOCKETS

1. See Figure 7-79. Remove the secondary locking wedge (6). Insert the blade of a small screwdriver between the socket housing and locking wedge inline with the groove (inline with the pin holes if the groove is absent). Turn the screwdriver 90° to pop the wedge up.
2. Gently depress terminal latches inside socket housing (3) and back out socket terminals (1) through holes in rear wire seal (2).
3. Fit rear wire seal (2) into back of socket housing, if removed. Grasp socket terminal approximately 1.0 in. (25.4 mm) behind the contact barrel. Gently push sockets through holes in wire seal into their respective chambers. Feed socket into chamber until it "clicks" in place. Verify that socket will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.
4. Install internal seal (5) on lip of socket housing, if removed. Insert tapered end of secondary locking wedge (6) into socket housing and press down until it snaps in place. The wedge fits into the center groove within the socket housing and holds the terminal latches tightly closed.

### NOTE

- The conical secondary locking wedge of the 3-pin connector must be installed with the arrow pointing toward the external latch. See Figure 7-80.
- If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the socket housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.

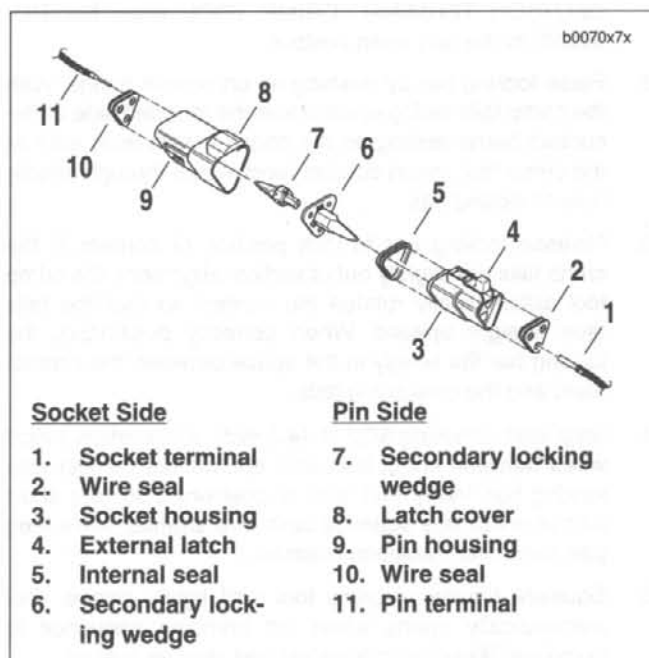


Figure 7-79. 3-Pin Connector

## REMOVING/INSTALLING PINS

1. See Figure 7-79. Remove the secondary locking wedge (7). Use the hooked end of a stiff piece of mechanic's wire or a needle nose pliers, whichever is most suitable.
2. Gently depress terminal latches inside pin housing (9) and back out pin terminals (11) through holes in wire seal (10).
3. Fit wire seal (10) into back of pin housing (9). Grasp crimped pin approximately 1.0 in. (25.4 mm) behind the contact barrel. Gently push pins through holes in wire seal into their respective numbered locations. Feed pin into chamber until it "clicks" in place. Verify that pin will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.
4. Insert tapered end of secondary locking wedge (7) into pin housing (9) and press down until it snaps in place. The wedge fits in the center groove within the pin housing and holds the terminal latches tightly closed.

## ASSEMBLY/INSTALLATION

Insert socket housing (3) into pin housing (9) until it snaps in place. To fit the halves of the connector together, the latch (4) on the socket side must be aligned with the latch cover (8) on the pin side.

## CRIMPING INSTRUCTIONS

1. See Figure 7-81. Squeeze the handles to cycle the DEUTSCH TERMINAL CRIMP TOOL (Part No. HD-39965) to the fully open position.
2. Raise locking bar by pushing up on bottom flange. With the crimp tails facing upward and the rounded side of the contact barrel resting on the concave split level area of the crimp tool, insert contact (socket/pin) through middle hole of locking bar.
3. Release locking bar to lock position of contact. If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the contact so that the tails face straight upward. When correctly positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.
4. Strip lead removing 5/32 in. (4.0 mm) of insulation. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over insulation material.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.

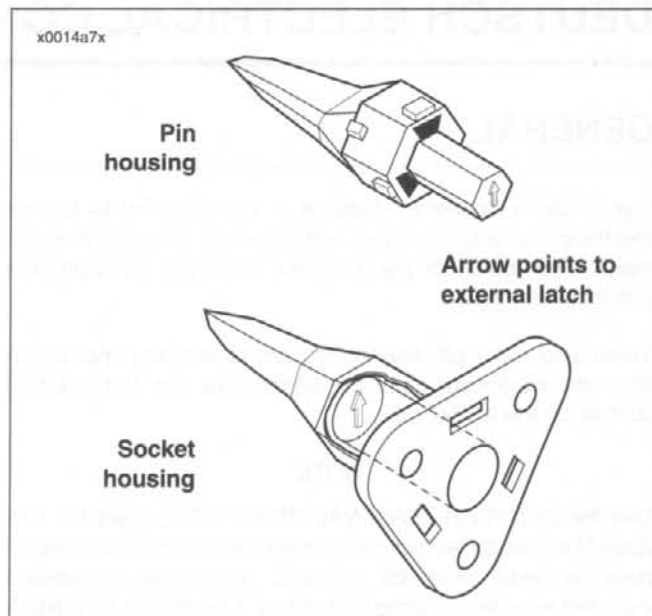


Figure 7-80. 3-pin Locking Wedge Orientation

### NOTE

Inspect the quality of the core and insulation crimps. Distortion should be minimal.

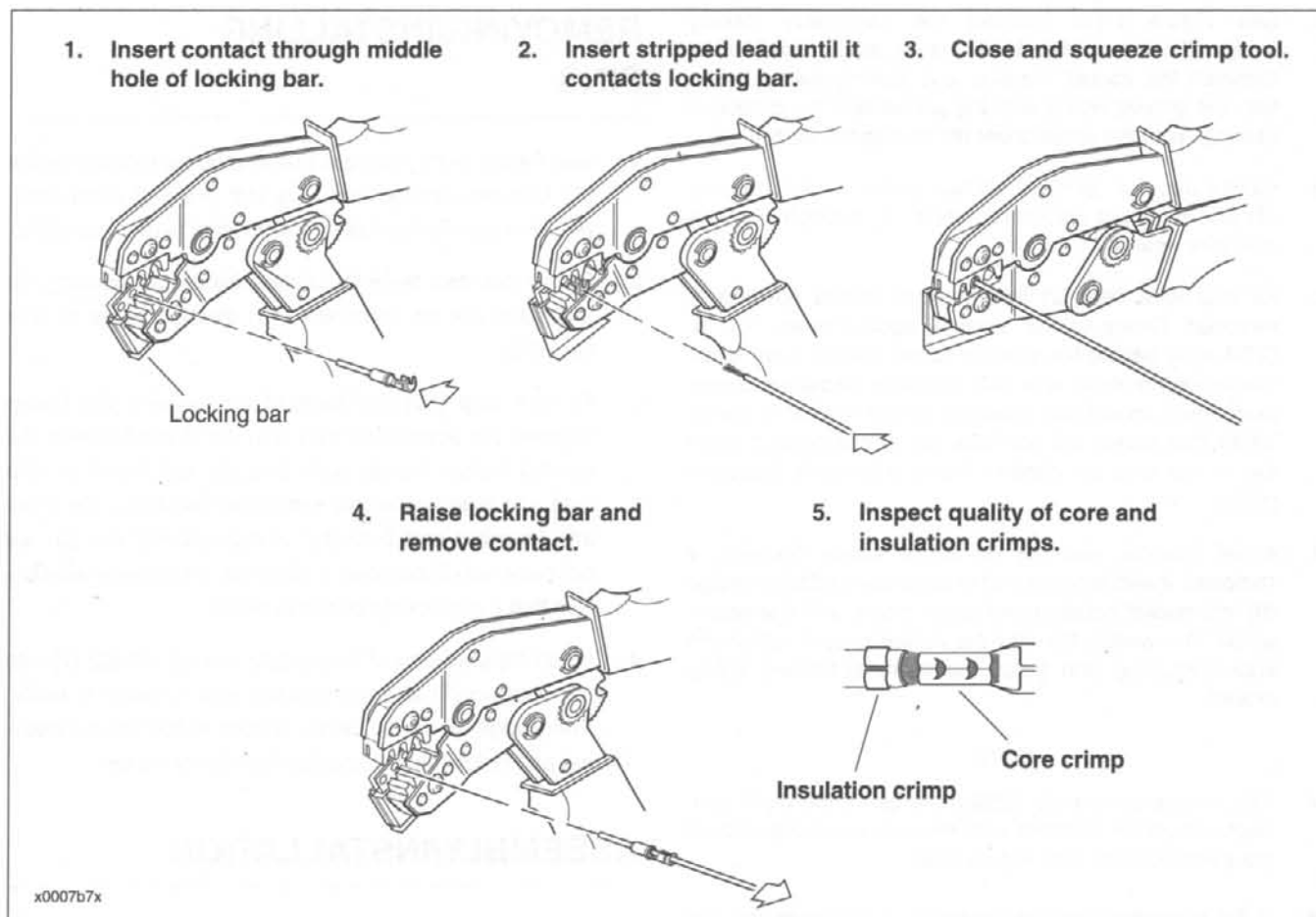


Figure 7-81. Deutsch Crimping Procedure

## REMOVING SOCKET/PIN TERMINALS

1. If necessary, cut any surrounding cable straps to gain access to the connector.
2. See Figure 7-82. Depress the button (5) on the socket housing (3).
3. Pull apart the pin and socket halves.
4. Bend back the latch slightly and free one side of secondary lock, then repeat the step to release the other side.
5. Rotate the secondary lock outward on hinge to access terminals in chambers of connector housing.
6. Looking in the terminal side of the connector (opposite the secondary lock), take note of the cavity next to each terminal.
7. Remove socket terminal (Figure 7-84.) or pin terminal (Figure 7-85.)
  - a. With the flat edge against the terminal, insert the pick (Snap-On TT600-3) into the cavity until it stops.
  - b. Pivot the end of the pick away from the terminal to release the tang.
  - c. Gently tug on wire to pull terminal from chamber. Do not tug on the wire until the tang is released or the terminal will be difficult to remove. A "click" is heard if the tang is engaged but then inadvertently released. Repeat the steps without releasing the tang.

### NOTE

An AMP TERMINAL CRIMP TOOL (Part No. HD-41609) is used to install Amp Multilock pin and socket terminals on wires. If **new** terminals must be installed, see CRIMPING INSTRUCTIONS.

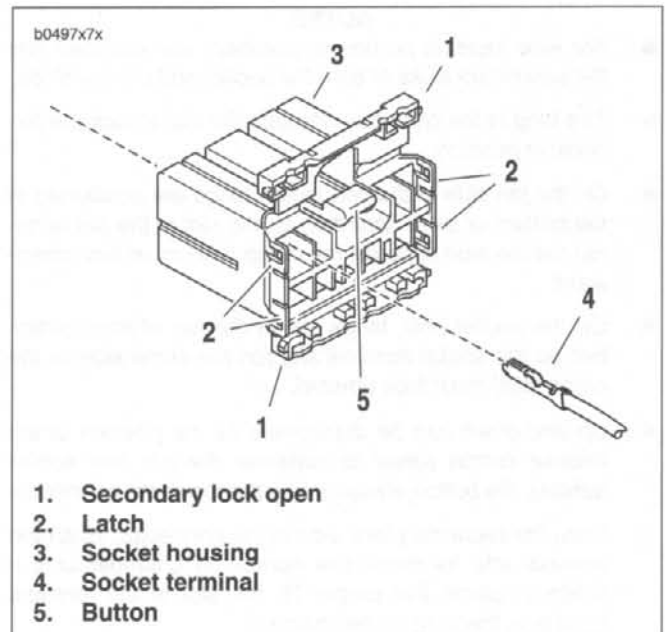


Figure 7-82. Socket Housing

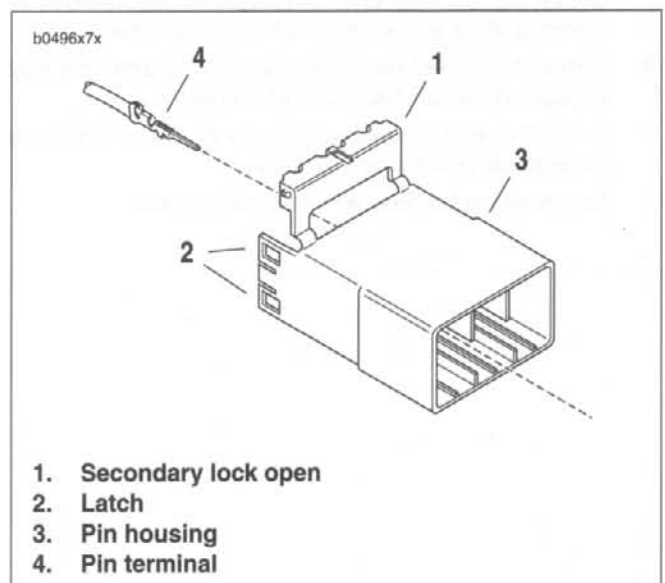


Figure 7-83. Pin Housing

## INSTALLING SOCKET/PIN TERMINALS

### NOTES

- For wire location purposes, numbers are stamped into the secondary locks of both the socket and pin housings.
  - The tang in the chamber engages the slot to lock the terminal in position.
  - On the pin side of the connector, tangs are positioned at the bottom of each chamber, so the slot in the pin terminal (on the side opposite the crimp tails) must face downward.
  - On the socket side, tangs are at the top of each chamber, so the socket terminal slot (on the same side as the crimp tails) must face upward.
  - Up and down can be determined by the position of the release button (used to separate the pin and socket halves), the button always being the top of the connector.
1. From the secondary lock side of the connector, insert the terminal into its respective numbered chamber until it snaps in place. For proper fit, the slot in the terminal must face the tang in the chamber.
    - a. If installing socket terminals, see Figure 7-84.
    - b. If installing pin terminals, see Figure 7-85.
  2. Gently tug on wire end to verify that the terminal is locked in place and will not back out of chamber.
  3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
  4. Insert the socket housing (plug) into the pin housing (receptacle) until it snaps in place.
  5. Secure wiring harness with **new** cable straps.

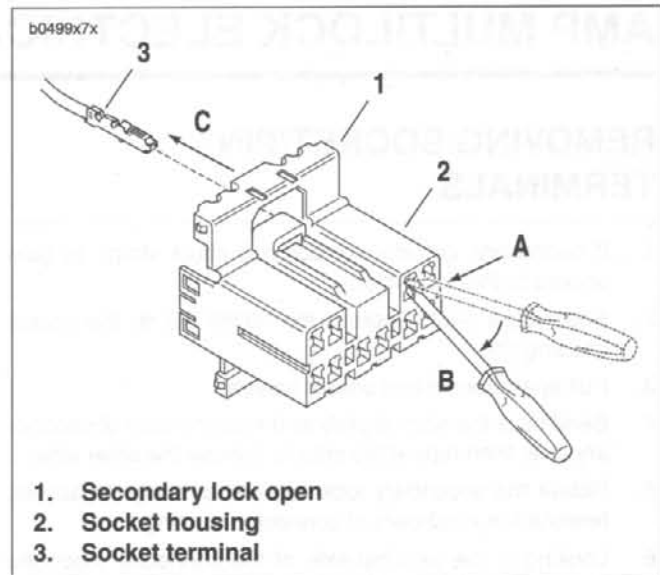


Figure 7-84. Socket Terminals

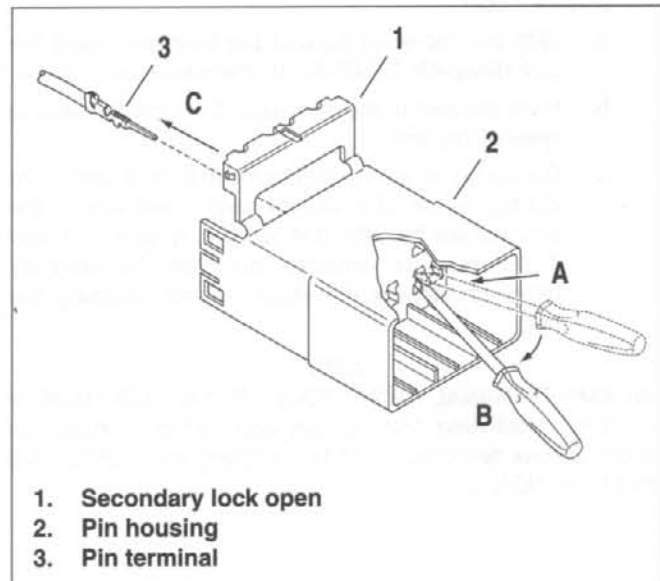


Figure 7-85. Pin Terminals

## CRIMPING INSTRUCTIONS

1. See Figure 7-87. Squeeze the handles to cycle the AMP TERMINAL CRIMP TOOL (Part No. HD-41609) to the fully open position.
2. Raise locking bar by pushing up on bottom flange. With the crimp tails facing upward, insert contact (socket/pin) through locking bar, so that the closed side of the contact rests on the nest (concave split level area) of the crimp tool. Use the front nest for 20 gauge wire, the middle for 16 gauge and the rear for 18 gauge.
3. Release locking bar to lock position of contact. When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
4. Strip lead removing 5/32 in. (4.0 mm) of insulation. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over insulation material.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.
6. See Figure 7-86. Inspect the quality of the core and insulation crimps. Distortion should be minimal.

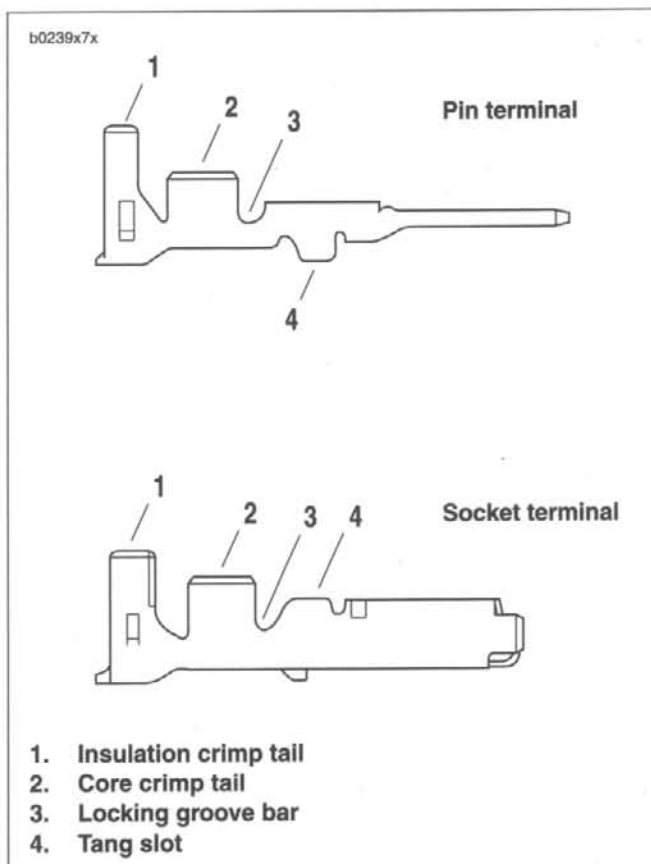


Figure 7-86. Crimps

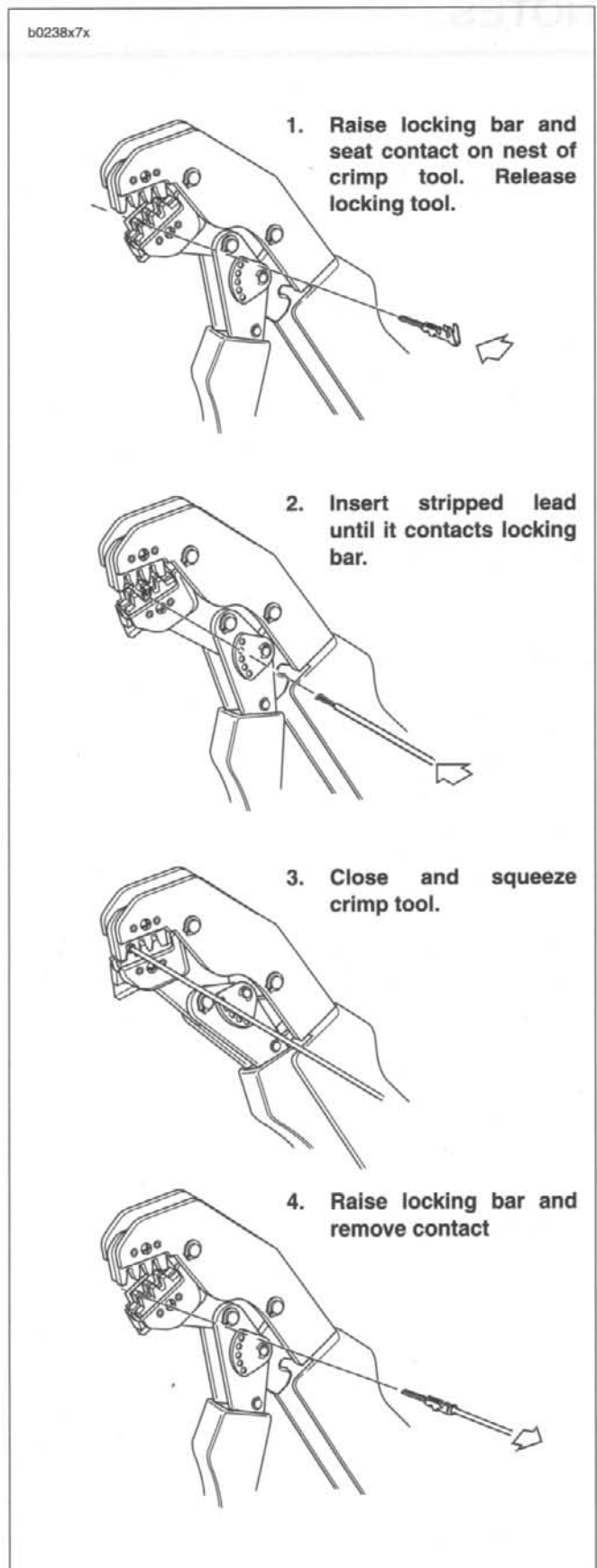


Figure 7-87. Amp Multilock Crimping Procedure

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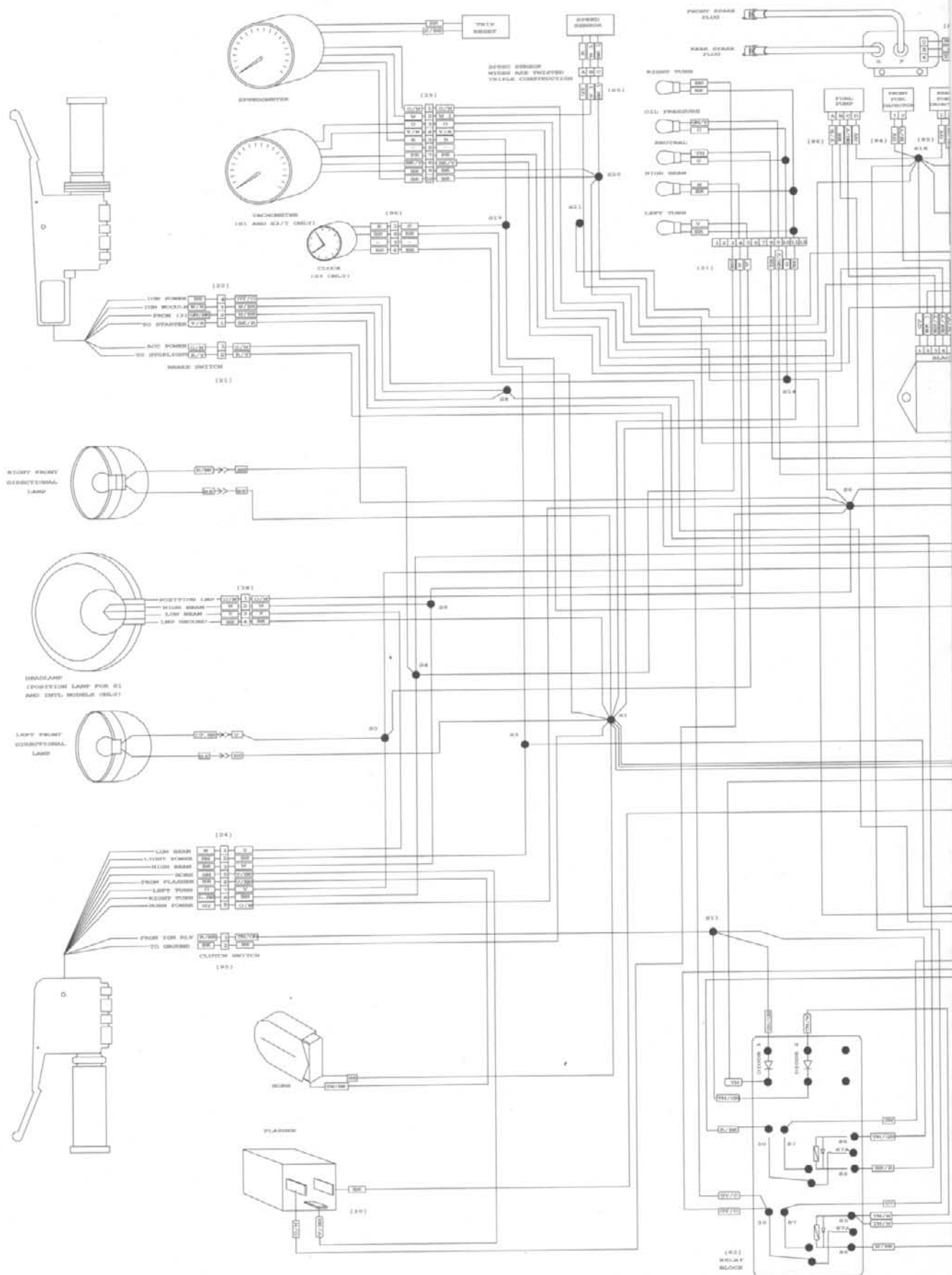
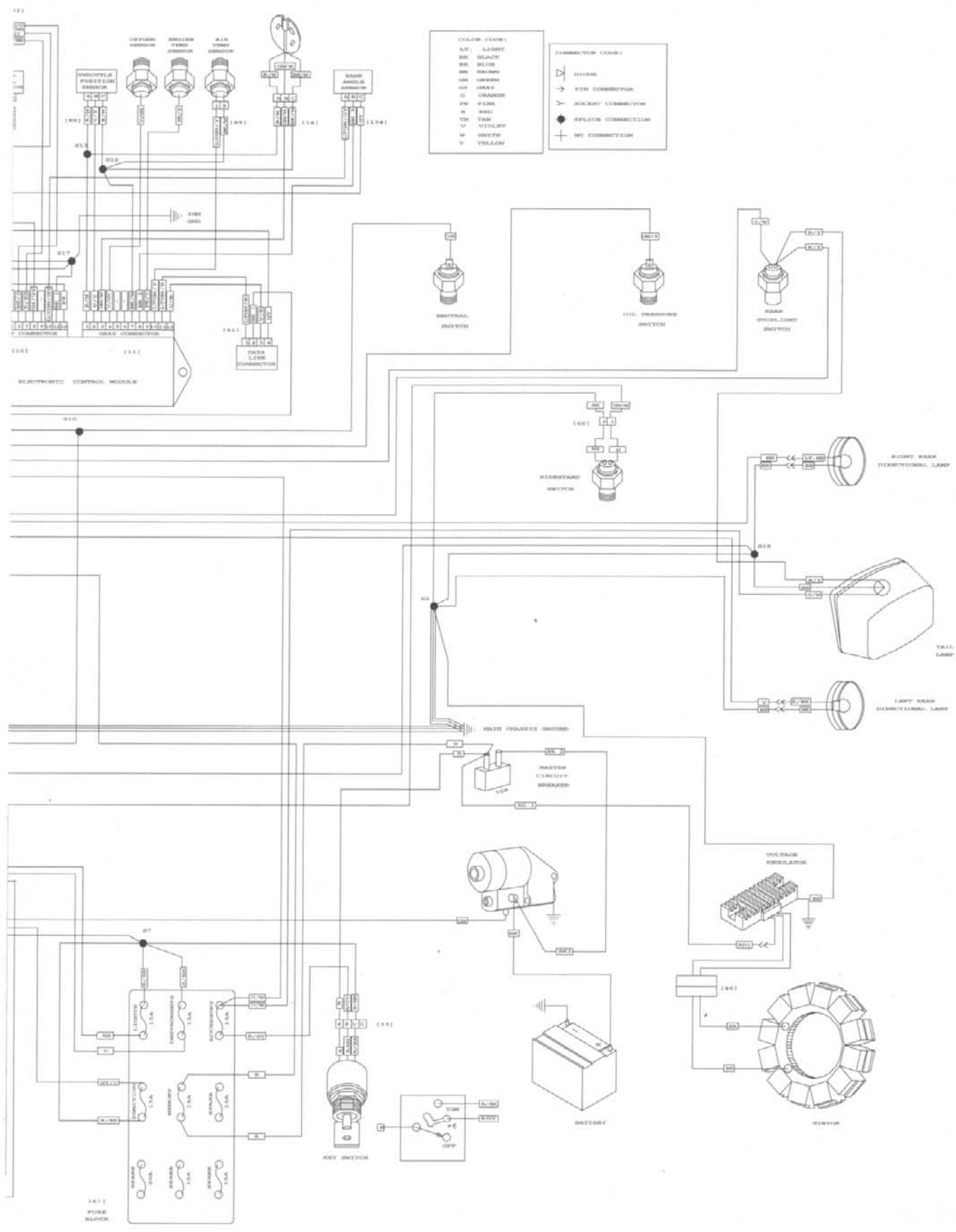


Figure 7-88. 1999 and 20





00 X1 Wiring Diagram